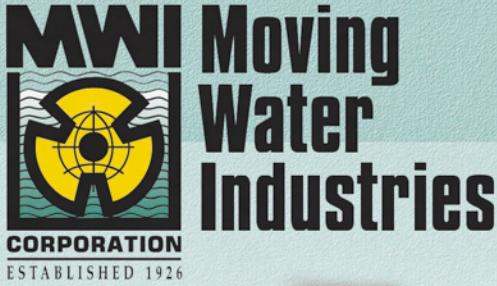


# OPERATION AND MAINTENANCE MANUAL



# Solar Pedalflo

A Complete Solar Powered  
Water Delivery System  
For Rural Communities



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# I. SOLAR PEDALFLO STANDARD FEATURES

The Solar Pedalflo product line has developed over the years, providing products that reach deeper depths and provide clean, safe water even in the most inhospitable conditions. Features for the Solar Pedalflo, model PF45M, include:

- Reciprocating pump
- 50 micron filtration for particle removal
- 350 watt solar power rack
- 1/2 hp motor
- HDPE weatherproof cover and base
- Large, easy to read pressure gages

## SOLAR PEDALFLO OPTIONS

- Pressure tank capable of holding 88 gallons at 15 psi
- Automatic proportional feeder for precise chlorination of water
  - with 5 gallon container for concentrated chlorinated feed stream
- 4 inch PVC well casing with a slotted well screen
- Additional water treatment filters (treating down to 1 micron)
- Additional below ground components for a total depth of 57M and a maximum TDH of 60M

## SOLAR PEDALFLO SPECIFICATIONS

The following chart shows the range of flow rates achievable at different total dynamic heads (TDHs). TDH is the sum of the height of the pumping water level plus the height of the water tower, and friction losses through pipes, fittings, valves, filters, etc.. For example, if the depth to water is 33 meters and the water tank is 7 meters high and there is an estimated 5 meters of loss through the piping network, the  $TDH = 33 + 7 + 5 = 45M$ .

TDH (M)	Flow (Lpm)	Flow (gpm)
10	27-28	7.0 - 7.5
20	25-27	6.5 - 7.0
30	23-26	6.0 - 7.0
40	20-25	5.0 - 6.5
50	17-22	4.5 - 6.0
60	15-18	4.0 - 5.0

The numbers are based upon actual performance data with a solar insolation of 1.0 - 1.1 kW/m<sup>2</sup> and the panels facing directly into the sun at 90 degrees.

## II. OVERVIEW OF MAJOR COMPONENTS

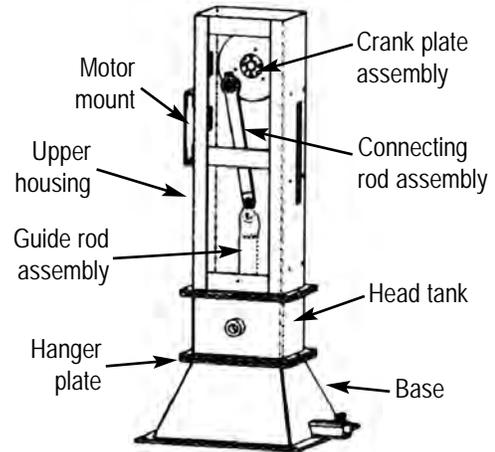
Many components make up the Solar Pedalflo, the major components being the main pump head assembly, below ground components, above ground components and solar power components.

### A. MAIN PUMP HEAD ASSEMBLY

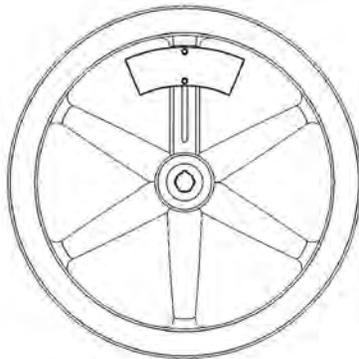
The pump head assembly is the mechanical heart of the Solar Pedalflo. Contained therein are the main pump head assembly, flywheel and the pedaling mechanisms, each playing a vital role in the operation of the Solar Pedalflo.

#### 1. Main Pump Head Assembly

The pump head is the main structure of the Solar Pedalflo, consisting of a base, hanger plate, head tank, upper housing, crank assembly and guide rod assembly. Constructed from mild steel, with the exception of the stainless steel head tank, the main pump head provides a rigid structure from which the below ground components are supported as well as housing for mechanical components necessary for operation of the Solar Pedalflo. Both the flywheel and pedal housing assembly are also mounted to the main pump head.



#### 2. Flywheel



The cast iron flywheel is an energy storage device. Radially adjustable counterweights mounted on the flywheel counter balance the load at different pump settings. The combination of flywheel and counterweights provide for smooth, efficient power transmission between the peddler or DC motor and the pump.

#### CAUTION

It is very important that the counterweights be set in proper positions to decrease any stress on the motor components. See Appendix D.

It is also important to understand that the counterweight settings are dependent on water depth. Because the water depth may change between dry and wet seasons, the counterweight may also need to be readjusted.

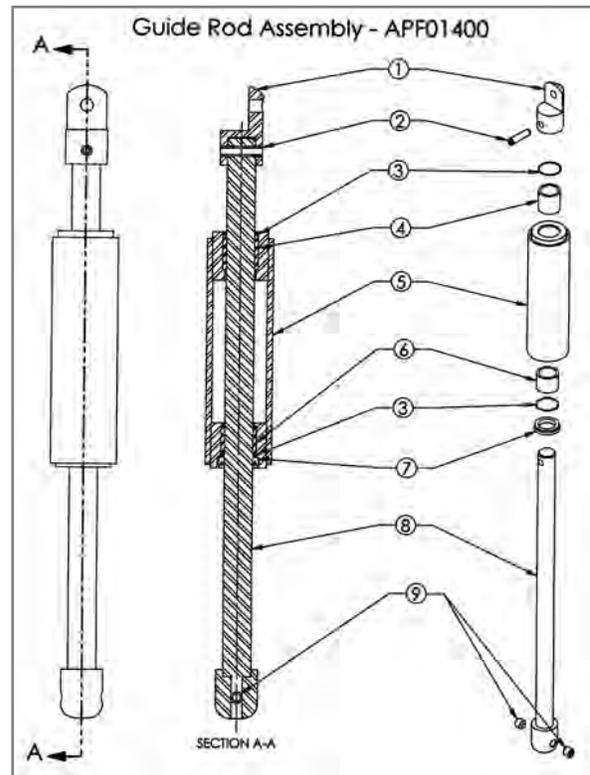
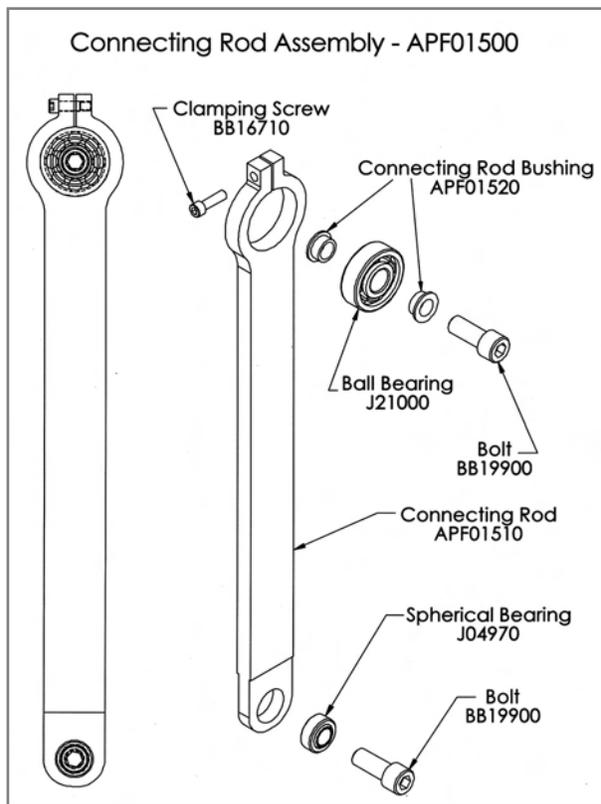
#### 3. Pedal Housing Assembly



The Solar Pedalflo operates using two chain-drive systems, including six sprockets, three heavy-duty chains and two clutches. The pedal housing assembly is the component used to operate the Solar Pedalflo by means of human power, and includes one clutch and two heavy-duty chains. The pedal housing assembly provides an efficient, sturdy mechanism for operators to pedal while resting on the adjustable seat.

## 4. Mechanical Components

Two important mechanical parts of the Solar Pedalflo are the Connecting Rod Assembly and the Guide Rod Assembly. These assemblies connect the pump rods to the crank plate which turns in conjunction with the flywheel in order to lift the water from the borehole. The guide rod and housing are stainless steel and contain two linear bearings and a lip seal. The bearings and lip seal can get worn if there is a lot of sand in the water. It is important that the well be pumped to remove sand before installing the Solar Pedalflo System. In addition, the bearings of the guide rod are lubricated by a small amount of water, so it is acceptable if a small amount of water leaks out of the top of the guide housing. The connecting rod assembly contains a spherical bearing and a ball bearing. These bearings require no lubrication and are very durable.



See Problem 2 in Troubleshooting for instructions on disassembly of guide rod housing

### Part List to Guide Rod Assembly

Item #	Part number	Description
1	APF01423	half clevis
2	BB29200	slotted spring pin
3	APF01450	retaining ring
4	J03770	upper linear bearing
5	APF01410	guide housing
6	J03760	lower linear bearing
7	E16500	lip seal
8	APF01420	guide rod
9	BB21450	set screw

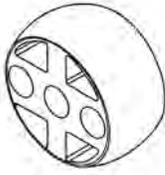
## B. BELOW GROUND COMPONENTS

The below ground components are comprised of the pump and its components, the pump rod and rod centralizers, the riser pipe and pipe centralizers, and well screen and casing. These components are the arm of the Solar Pedalflo, lifting water to the surface.

### 1. Pump Components

Pump components are manufactured to SKAT (Swiss Center for Appropriate Technology) specifications providing a strong yet lightweight, efficient plunger pump, capable of lifting water from depths up to 57 m (187 ft).

## 2. Pump Rod and Centralizers



The pump rod is made of 304 Stainless Steel to inhibit oxidation. The rods are threaded on one end with a 304 Stainless Steel nut welded on the other end. Rods are coupled to each other and the use of a thread locking compound ensures a secure pump rod string.

The Nitrile-rubber rod centralizers are placed on each rod section to center the rod in the middle of the riser pipe.

## 3. Riser Pipe and Centralizers



The riser pipe is the conduit in which water travels from the well to the head tank. PVC cleaner and glue are provided to ensure that each section of pipe is bonded together properly, providing a strong, sealed section of pipe.

In order to maintain a straight section of riser pipe within the well casing, pipe centralizers are placed on the riser pipe every three meters. The outside diameter of the pipe centralizer should match the inside diameter of the well casing. Pipe centralizers are available for 4" casing (standard), with optional 6" and 8" centralizers for corresponding casing sizes.

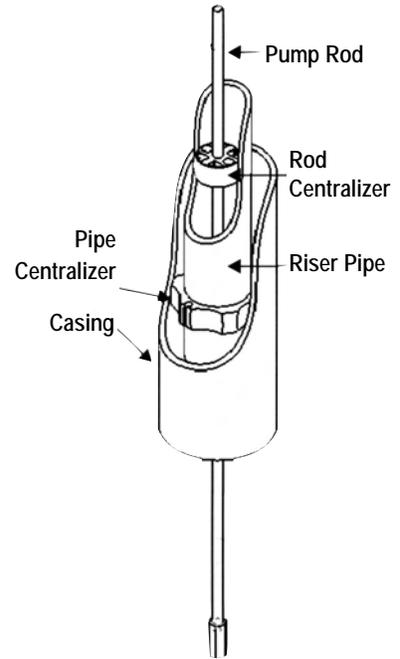
## 4. Well Screen and Casing (Option)

A well screen is a filtering device that serves as the intake portion of the well. It allows water to enter the well, but minimizes sediment from entering the well. The well screen is a special section of slotted PVC pipe.

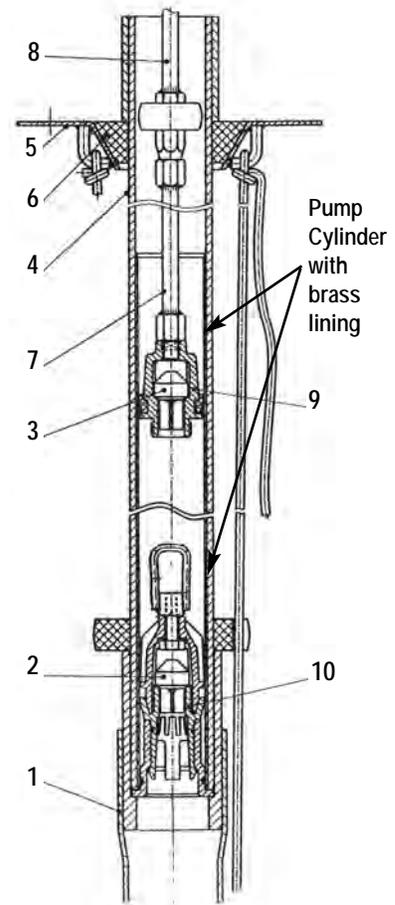
Well casing provides stability to the well. It prevents collapse, and acts as a structure for the pump equipment and a vertical conduit for water flowing upward from the aquifer to the pump intake.

Wells are typically drilled and cased by the customer prior to Solar Pedalflo installation.

Item #	Items Part #	Description
1.	90160	Suction Pipe
2.	90167	Bobbin
3.	90167	Bobbin
4.	90157	Riser Pipe
5.	APF01100	Hanger Plate
6.	90156	Rubber Cone
7.	APF00520	Plunger Pump Rod
8.	APF00510	Longer Pump Rod
9.	90182	Pump
10.	APF90180	Foot Valve Assembly



Detailed Schematics of Below Ground Components



## C. ABOVE GROUND COMPONENTS

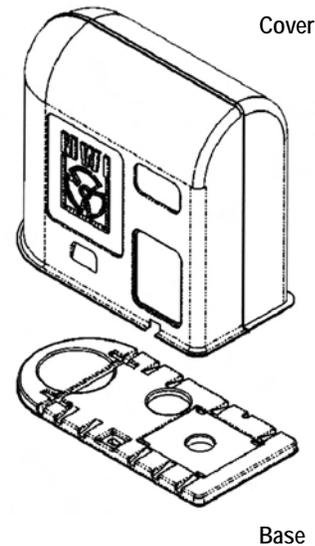
The above ground components combine to form the visual portion of the Solar Pedalflo. They include the concrete foundation, blue cover, PVC pipe and fittings, relief valve and gauges, filter, and optional chlorine metering and pressure tank.

### 1. Concrete Pad

The concrete pad forms the foundation on which the Solar Pedalflo is installed. The concrete pad, reinforced with wire mesh, has embedded anchors to which the main pump head base is secured. See Appendix A for a list of materials and instructions on building the form for the concrete base.

### 2. HDPE Plastic Base and Cover

The HDPE (high-density polyethylene) plastic base and housing are vacuum-formed. The base is of a twin-sheet construction, providing excellent strength and durability. The HDPE base is laid on top of the concrete pad. All other above ground components, as well as the pump head, are then installed. The HDPE cover is installed last by securing it to the HDPE base, as it provides protection from the elements (wind, sun, rain, etc.).



### 3. PVC Pipe and Fittings

The Solar Pedalflo uses several types of PVC hoses and fittings. One inch flexible PVC hose is used to plumb between most components. All PVC components are sized appropriately for their particular application. For distributing water outside of the Solar Pedalflo housing, 40 - 50 mm (1 1/2" - 2") pipe is recommended. Appendix B shows the plumbing layout with the chlorine feeder and pressure tank installed.

### 4. Relief Valve and Pressure Gauges

The Solar Pedalflo comes equipped with two pressure gauges and one relief valve. The pressure gauges measure the system pressure and the tank pressure as indicated on the gauge. The relief valve protects the system from elevated pressure, relieving at pressures in excess of 448 kPa (65 psi). To better understand the Pressure Gauges, see Operation Procedures.

### 5. Chlorine Metering System (Option)

The chlorine metering system consists of an Automatic Proportional Feeder and a 5 gallon feed container. The container holds the mixture of chlorine and water which is drawn out by the Automatic Proportional Feeder. The Automatic Proportional Feeder is factory set to meter the proper amount of chlorine/water mixture in order to eliminate most bacteria and algae, providing clean, safe drinking water. A check valve is also installed to prevent any chlorine from entering the well.

For user operation see Operating Procedures.

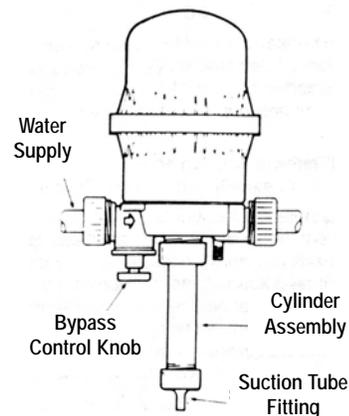
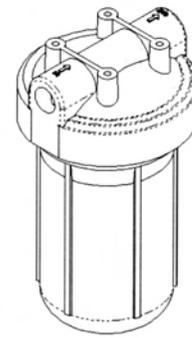


Diagram of APF for chlorination

## 6. Sediment Filter System

The Solar Pedalflo is equipped with a sediment filter system to remove sand and other particles from the water. The filter element is capable of removing 90% of all particles 50 microns and larger. The filter is reusable and can be cleaned for extended life. Refer to the maintenance section for filter change instructions.



Sediment filter system

## 7. Pressurized Water Tank (Option)

The pressurized water tank is used as a water storage container when pressurized water is required. It is a fiberglass bladder tank that works by compressing the air inside the bladder as the water fills up the tank.

The pressure is pre-set at the factory with a minimum pressure setting of 20 psi. To change the setting, see Operation Procedures.



pressurized water tank

## D. SOLAR POWER COMPONENTS

The solar power components consist of the solar panels and solar panel stand, DC motor, pressure switch, and linear current booster.

### 1. Solar Panels and Stand

The solar panels provide the energy to operate the DC motor. There are 7 solar panels, each rated at 50 watts, arranged in series, that form the solar array.

### 2. DC motor

The parallel-shaft, high-torque, DC motor provides the driving force for the plunger in the well. The DC motor is linked to the chain drive and operates the Solar Pedalflo using solar energy. The motor requires 90 VDC to operate, which is provided by the solar panel array. The 1/2 hp motor selected for the Solar Pedalflo has been rigorously tested to ensure durability.



Solar panels and Stand

### 3. Pressure Switch

The pressure switch acts as a safety mechanism for the Solar Pedalflo. When the system pressure exceeds a safe limit (65 psi) the pressure switch, connected between the solar panel array and the DC motor, switches the motor off until an acceptable system pressure is reached. Please consult a factory technician before changing settings.

### 4. Linear Current Booster

The linear current booster is a device that alters the current flow to the DC motor when under load. This allows the Solar Pedalflo to safely start and operate under low-light conditions. The DC motor is protected from excessive current coming from the linear current booster using an inline fuse located next to the toggle switch on the cover. The fuse is rated for 10 amps.. The fuse is easily accessible from the front cover of the Solar Pedalflo.

### III. INSTALLATION PROCEDURES

Installing the Solar Pedalflo might seem like a daunting task, however, the instructions provided here will provide simple guidance allowing the installer to accomplish the task in a minimal amount of time. No similar consumer product is as easily installed and built to the high standards of quality and durability as the Solar Pedalflo.

#### A. **RECOMMENDED TOOLS**

The Solar Pedalflo can be assembled with a minimal amount of tools. The following table is our recommended list of tools for installation.

MWI Part #	Description	Qty
TT31115	12" Adjustable Wrench	1
TT31300	7" Locking Wrench for Pump Rods	2
TT31750	18" Pipe Wrench	1
TT35105	Ball Pin Hammer	1
TT35610	Combo Plier, Wire Stripper, and Crimper	1
TT36220	8 pc Combination Wrench Set	1
TT38100	24" I-beam Level	1
TT72780	8 pc Screwdriver Set	1
TT73350	5/16" Nut Driver	1
TT76000	9 pc Hex Wrench Set	1
TT00390	10" Hacksaw	1
TT00395	Hacksaw Blade, 24 tpi	2
U02500	8 oz Anti-Seize Lubricant	1
U04001	1/2" Teflon Tape	2
U08500	20 oz Lock N' Seal Adhesive	2
S99000	8 oz PVC Cement	2
S99500	8 oz PVC Cleaner	2

These tools can be obtained individually or as a kit through any MWI local representative or by calling MWI Mechanical Services Department in the United States at (954) 426-1500. The kit is listed as MWI part # PF450805 and includes all the items listed above along with a heavy duty tool box allowing easy carrying convenience.

#### B. **WELL SPECIFICATIONS**

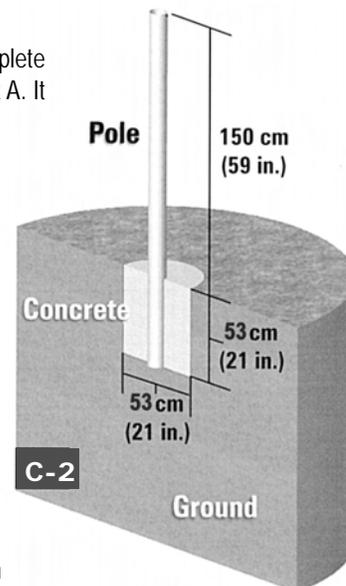
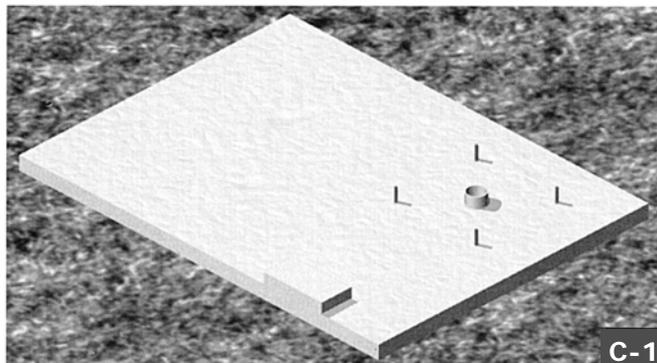
Before a Solar Pedalflo can be installed, certain physical characteristics of the well and its performance must be determined. They are as follows:

- Pumping Water Level - should not exceed maximum of 40 m (130 ft) for the 45 m unit or 55 m (180 ft) for the 60 m option
- Well Yield - should be greater than 30 Lpm (8 gpm)
- Diameter of Casing - should be 10.2 cm (4"), 15.2 cm (6"), or 20.3 cm (8")

Wells are required to be straight and plumb. According to the US Environmental Protection Agency, wells are to be within 1 deviation from plumb per 15.2 m (50 ft). This translates into 0.4 m (1.3 ft) allowable deviation per 45.7 m (150 ft). Information about your well should be obtained from the drilling company or local officials before installing a Solar Pedalflo. With these conditions met, we are ready to begin installation of the Solar Pedalflo.

## C. LAYING THE FOUNDATION - POURING THE CONCRETE BASE

The concrete base is the foundation on which the Solar Pedalflo is installed (C-1). A complete list of materials required to build the form, along with a diagram, are available in Appendix A. It is recommended that the services of a local mason be acquired.



Once all components have been gathered together, and an area around the well has been prepared (leveled as best possible), assemble the form around well according to specifications found in Appendix A, level and secure the form, insert the wire mesh and J-bolts, and pour the concrete. The J-bolts need to stick out 4 1/2" above the top of the concrete base.

The solar panel base pole should also be installed at this point (C-2). The base pole is to be installed 4.6 m (15 ft) from the Solar Pedalflo or less. If necessary to install solar panel stand further from the Solar Pedalflo, a longer length of 3-conductor cable should be ordered. The base pole should be mounted in the ground with a concrete foundation of 53 cm (21 in) diameter by 53 - 60 cm (21 - 24 in) deep. During installation, check pole and level (C-3).



## D. INSTALLATION OF THE MAIN PUMP HEAD BASE

The main pump head base is the first item to be installed after the concrete has cured for 24 to 48 hours. The following steps describe the base installation.

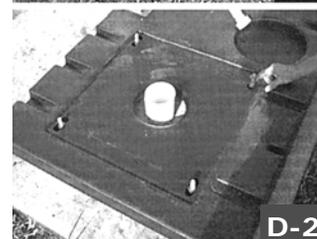
**Step 1.** Place black HDPE base on concrete pad (D-1).

**Step 2.** Slide spacers over the four J-bolts (D-2). Spacers should rest on the concrete pad and slightly protrude out of the top of the HDPE base. There is one spacer for each J-bolt.

**Step 3.** Place the main pump head base on the J-bolts and tighten nuts down (D-3). Use second set of nuts to lock against the first set.

**TIP**

If the concrete pad is not level, the spacers can be eliminated and the eight nuts can be used to level the main pump head base. This is accomplished by installing the HDPE base and fastening four nuts onto J-bolts. Place the main pump head base over the J-bolts, onto the nuts and level by adjusting the nuts up or down. Make certain that base cannot rock diagonally, but that it rests securely on all four nuts. Use the remaining four nuts to secure the base from the top.



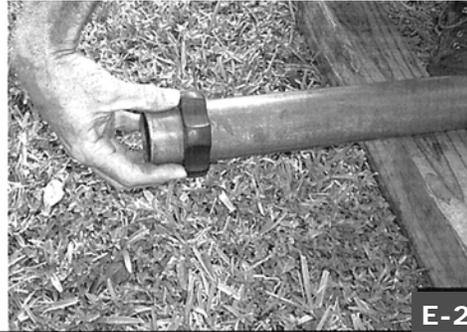
## E. INSTALLATION OF THE PUMP ASSEMBLY AND RISER PIPE

Once the HDPE base and main pump head base have been installed, the below ground components can be installed. The following steps describe the procedure of installing the pump assembly and riser pipe.

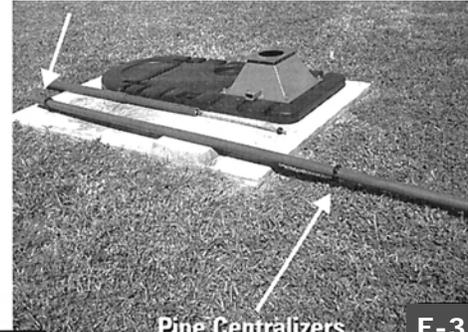
- Step 1.** Prepare the pump assembly and riser pipes by removing the plunger assembly (E-1) from the pump cylinder. The pump cylinder is the shortest of the grey riser pipes with a length of 75 inches (1,910 mm). Slide (E-2) two pipe centralizers onto each section of riser pipe, one in the center of each section of riser pipe and one approximately 15 cm (6 in.) from the straight end of each section of riser pipe (E-3).



E-1



E-2

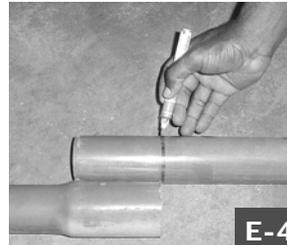


Pipe Centralizers E-3

**TIP**

Wetting the riser pipes and centralizers with water will make it easier to slide the centralizers onto the riser pipe sections.

- Step 2.** Prepare pump cylinder to connect to first section of riser pipe by marking the insertion depth (E-4) of the pump assembly into the riser pipe bell end.



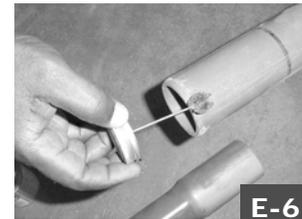
E-4

- Step 3.** Make sure the pipe centralizer on the end passes the mark just placed on the pump assembly.



E-5

- Step 4.** Prime the inside of the bell and the outer portion of pipe on the pump cylinder with purple PVC cleaner (E-5,6). Place PVC cement on both the inside of the riser pipe bell and the outer portion of the pump assembly. Insert pump assembly into riser pipe bell. Make sure the end of bell is located at marked position on pump assembly (E-7).

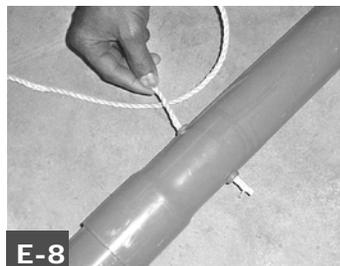


E-6

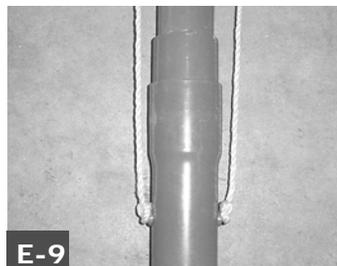
- Step 5.** Attach rope to pump cylinder by threading the rope through the sleeve in the suction tube of the pump cylinder (E-8). Pull rope through until there are equal lengths on either side. Tie a knot on each side of suction tube to keep rope in place (E-9). Slip rope into notches on pipe centralizers (E-10).



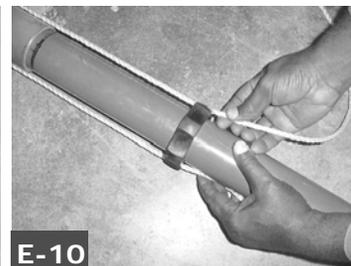
E-7



E-8



E-9



E-10

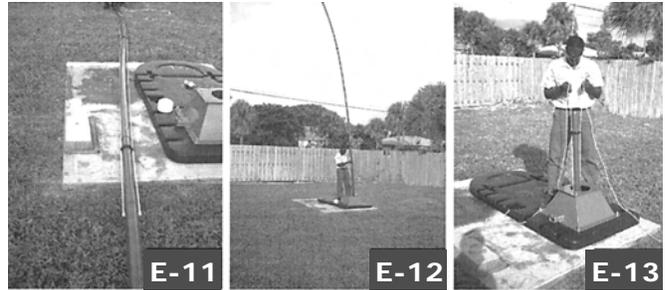
**CAUTION**

Use gloves when holding rope or riser pipe to prevent injury.

**Step 6.**

Lower pump cylinder and first section of riser pipe (E-11) into well (E-12). Lower assembly until approximately 30 cm (12 in.) of pipe is left above the top of the base. Slip rope into notches on pipe centralizer. (E-13)

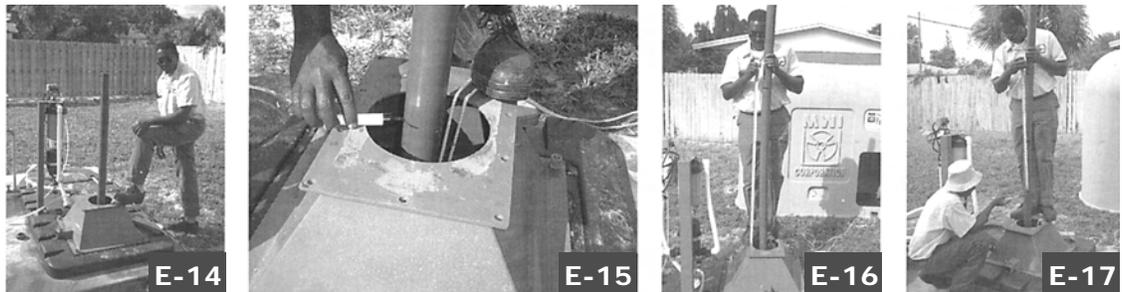
Secure riser pipe using the two ends of the rope.

**Step 7.**

Prime, cement, and connect by twisting the next section of pipe to the pipe section protruding from the well. Let cemented section dry for approximately five minutes. Make sure to put pipe centralizers on each section. Repeat this step until pump rests on the bottom of the casing.

**Step 8.**

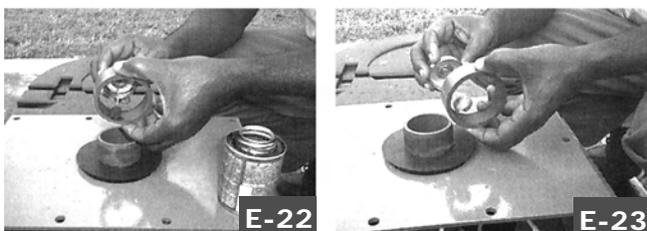
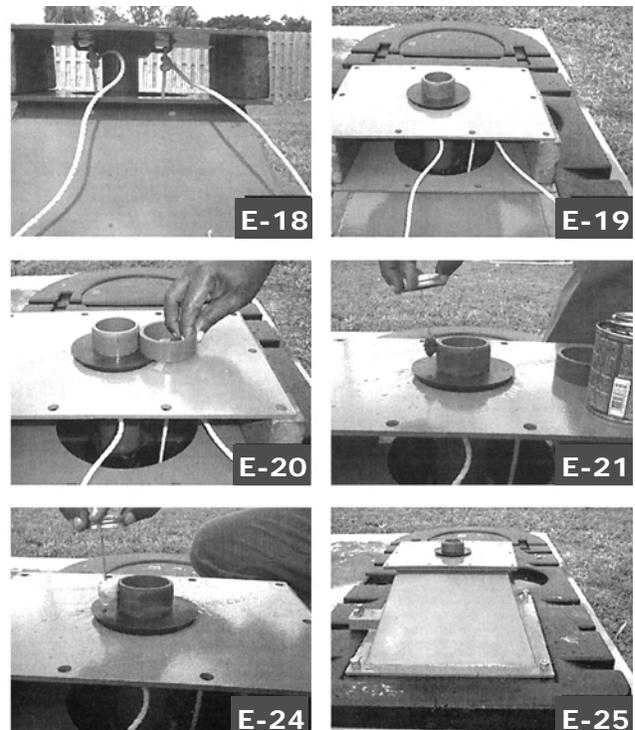
With pump resting on the bottom of well (E-14), mark riser pipe even with the top of the main pump head base (E-15). Raise riser pipe (E-16) approximately 1.2 meters (4 ft) and cut pipe 1 meter (3 ft) below mark (E-19) using hacksaw.

**Step 9.**

Place hanger plate over riser pipe. Set two wood blocks between the hanger plate and the base. Tie the two ends of the rope to the loops on the bottom of the hanger plate (E-18). Slide rubber cone onto riser pipe (E-19). Glue PVC collar on the end of riser pipe (E20-E25) using the purple primer and cement and then sliding the collar onto the pipe. Allow 5 minutes for glue to dry. The extra length of rope can either be tucked into the hole of the base or can be cut and the ends burned to keep from unraveling.

**Step 10.**

Remove wood blocks and set hanger plate on top of the base and align holes. Push down on the riser pipe until cone and collar are seated (E-25).

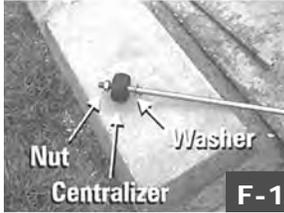


## F. INSTALLATION OF PLUNGER AND PUMP ROD

With the riser pipe installed and the hanger plate aligned, the plunger and pump rods can now be installed.

### Step 1.

Connect the plunger rod to a long pump rod. Verify that the washer, rod centralizer and nut (F-1) are on the plunger section before connecting the first pump rod section. Use lock-tite on the threads before connecting first rod (F-2). With rod fully tightened, run the nut up against the face of the rod to secure it (F-3). Lower this section into the well, plunger first (F-4).



### TIP

As the pump rod string gets longer, it becomes increasingly difficult to hold by hand. Use the rod clamps (Vice Grips) to hold the rod string while installing the next section of rod. (F-5) Always make sure a vicegrip is on the rod as you lower the rods down, otherwise all of the rods may drop into the well and be hard to retrieve.

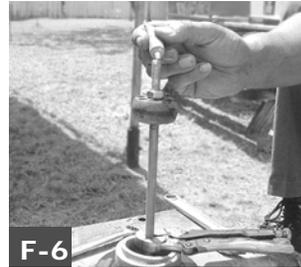
### Step 2.

After lowering the first section, assemble the next section. Again, verify that the washer, rod centralizer and nut are on before connecting. Use lock-tite on the threads before connecting first rod (F-6). With rod fully tightened, run the nut up against the face of the rod to secure it (F-7).



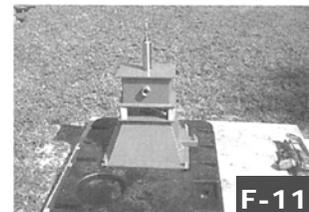
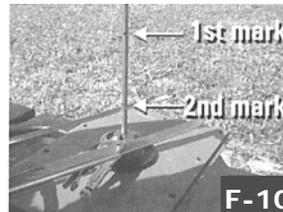
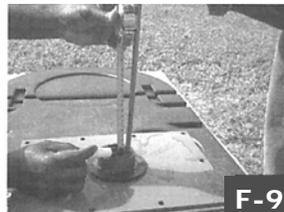
### Step 3.

Repeat STEP 2 until the plunger rests on top of the foot valve. Immediately before the foot valve, the plunger u-seal will enter a brass lining which should be noticeable. Make certain that the plunger section enters the brass liner and rests on top of the foot valve.



### Step 4.

With plunger resting on top of foot valve, mark the pump rod even with the top of the riser pipe (F-8). Raise the pump rod string up 12 cm (4.75") and again mark the pump rod even with the riser pipe (F-9). Raise pump rod up and cut at the second mark (F-10) using hacksaw.



### Step 5.

With the rod string cut to length as described in Step 4, use rod clamp to hold the rod. Lower the head tank, with Guide Rod Assembly installed, over the last rod section and rest on wood blocks (F-11, 12). Insert the rod into the receiver of the Guide Rod Assembly. Verify rod inserted completely. The rod should go 1.5 inches (3.8 cm) into the receiver. Tighten both set screws into the rod. (F-12)

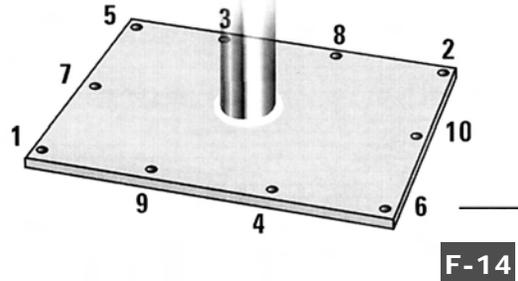
### CAUTION

If the set screws are not tight and the rod clamp is released, the pump rod string will fall into the well and will be difficult to retrieve.



**Step 6.**

With the rod string secured into the Guide Rod receiver, remove the wood blocks and lower the head tank onto the hanger plate. Align the holes in the head tank with the holes in the hanger plate and insert all bolts (F-13). Tighten bolts using the following pattern (F-14).

**F-14****F-13****G. PUMP HEAD ASSEMBLY**

With the head tank assembled, the upper housing and all internal and external pump head components can be installed.

**Upper Housing****Step 1.**

Set the upper housing (G-1) onto the head tank (G-2). The upper housing should have all components (crank plate, gears, etc.) installed (except flywheel and cover) before mounting to head tank.

**Step 2.**

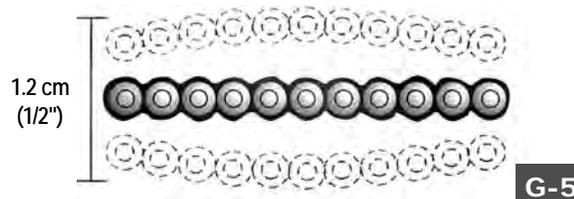
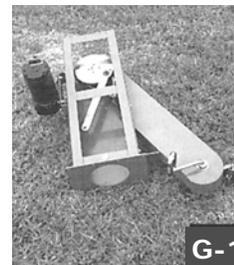
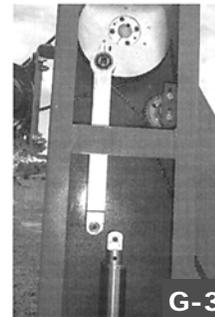
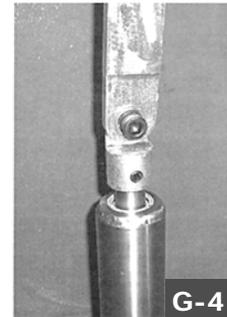
Secure the upper housing to the head tank using provided fasteners following the same pattern as used with the head tank, hanger plate, and base (F-14).

**Step 3.**

Connect the connecting rod to the guide rod (G-3,4). This requires pulling up the guide rod to line up the holes. Then insert bolt and tighten.

**Step 4.**

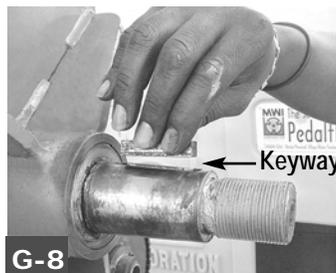
Check tension in all chains. Chains should be able to flex 1.2 cm (1/2") approximately (G-5).

**G-5****G-1****G-2****G-3****G-4****CAUTION**

The flywheel is very heavy. Lift with caution

**Step 5.**

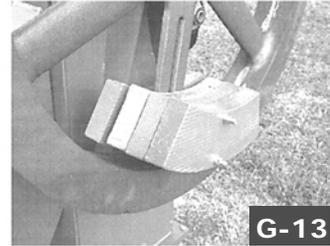
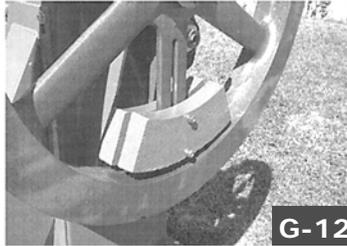
To mount the flywheel (G-6), first remove all shipping materials from around the shaft including plastic and tape (G-7). Set the keyway to top center and insert key (G-8). Remove nut and washer. Use Anti-Seize on the entire tapered portion of shaft where the flywheel will rest (G-9). Remove counterweights from flywheel. Lift flywheel and slide onto shaft. The keyway on the flywheel must match up with the key on the shaft. The flat face of the flywheel hub faces out; the machined, inset face of the flywheel hub faces the main pump head.

**G-6****G-7****G-8****G-9**

Slide large washer on and tighten nut onto shaft, securing the flywheel into position (G-10,11). Mount the necessary counterweights to the flywheel. Refer to Appendix D to determine the correct number of counterweights and the counterweight location for a given setting. Only mount one counterweight on the pump housing side of the flywheel. One to three counterweights may be mounted to the flywheel side facing out (G-12, 13). Make sure the counterweights are secured into position by tightening the nuts on the bolts.



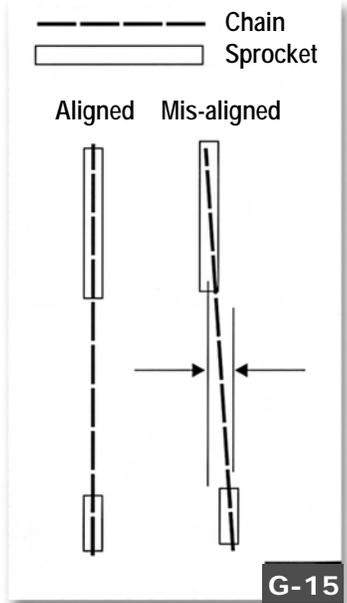
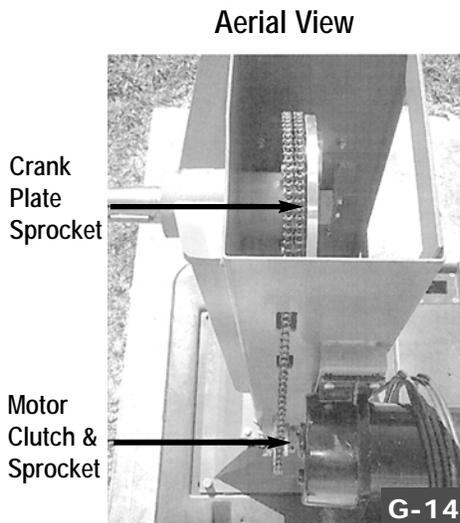
**TIP** Sometimes it is necessary to file down the ends of the bolts to keep from hitting the blue cover.



**Step 6.**

Test the chain drive by slowly turning pedals by hand. This will indicate whether the chain drive is aligned and functioning properly. Observe the chain as it rolls across the sprockets (G-14). Verify the chains are aligned on the pedal and motor clutch sprockets as well as the crank plate sprockets (G-15). If a grinding sound is heard, the chain is not properly aligned.

To test the system, continue turning the pedals until water exits the head tank at the coupling (G-16). Once water is observed, continue with setup. The cover can now be put on the upper housing (G-17).



## H. SOLAR PANEL STAND SETUP AND WIRING

With the solar panel base pole secured in concrete, the swivel mount and solar panel frame can now be installed. The swivel mount slides onto the pole and the frame gets attached to the swivel mount by inserting the four bolts with their washers and nuts (H-1).

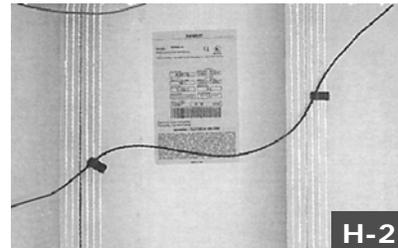


### CAUTION: SHOCK HAZARD

Wires should be considered live, as the solar array generates electricity even under low light conditions.

#### Step 1.

Secure the red and black wires to the back of the solar panels using the wire clips (H-2). The solar panels are prewired in series at the factory (see electric circuit diagram in Appendix). It is important that the panels be wired in series to provide the necessary voltage and amps needed to run the motor.



#### Step 2.

On one end of the assembled panels is long length of red wire and on the other end is a long length of black wire. These wires are the positive and negative ends of the solar system. These need to be inserted into the linear current booster. Make sure the toggle switch on the booster is in the off position. The red wire goes into the terminal labeled PV+ and the negative black wire goes into the terminal labeled PV-. (H-3). Remember to strip the end of the wire to expose the copper before inserting.



#### Step 3.

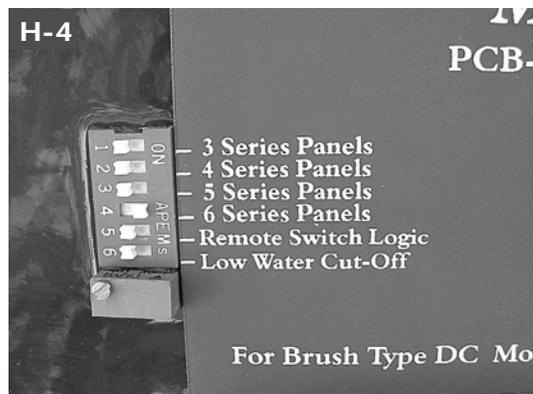
On the left side of the booster are small switches (H-4). Make sure that switch 4 (for 6 series panels) is pushed to the right and all other switches are pushed to the left.

#### Step 4.

The 25 foot black cable connects the linear current booster to the toggle switch inside the cover. One end of the cable has three open ended wires and the other end has terminal connections attached to two of the wires. The open ended wires need to be stripped and inserted into the linear current booster. The white wire goes into the terminal labeled LD+ and the black wire goes into the terminal LD-. The green wire is the ground and gets inserted into the back right of the booster in one of the screw terminals.

#### Step 5.

The rest of the wiring is covered in Section J. Perform the steps in section I and J and then refer to Operation Procedures for further information on the linear current booster.



## I. INSTALLATION OF ACCESSORIES

The plumbing layout is shown in Appendix B with the pressure tank and automatic proportional feeder installed.

### Pressure Tank (Option)

Place the pressure tank in the proper location on the black HDPE base where there is a circular indentation. Make sure the union joint on the bottom of the pressure tank is facing toward the pump head. Use the fasteners that were supplied to secure the tank into position. Remove the union (or plug if the pressure tank is being installed as a field kit (I-1)) and connect to the pressure tank (I-2). Verify that the o-ring in the union is in place.

The pressure tank comes pre-charged at the factory to 20 psi. If you would like to change the pressure setting, then lay the pressure tank on its side and remove the cap from the top (I-3).

Attach a pump with a Schroeder valve (bicycle pump) and either add more air pressure or release air in order to adjust the pressure tank setting.



### Automatic Proportional Feeder (Option)

#### Step 1.

It is easy to attach the chlorination system to the SPF. If the chlorination system was purchased at the same time as the SPF, it is preinstalled at the factory. Skip to Step 3.

If it was purchased as a field kit, then remove the top portion of the pipe clamps on the accessory stand (I-4).



#### Step 2.

Remove the pipe between the two unions and attach the APF in that location.(I-5, I-6)



#### Step 3.

Connect the hose from the blue plastic jug to the automatic proportional feeder (I-7). Make sure the intake section on the end of the hose located inside the bucket is fully submerged.

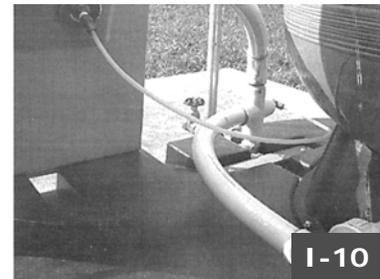
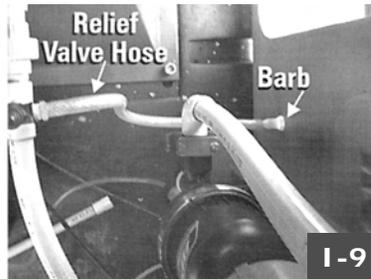
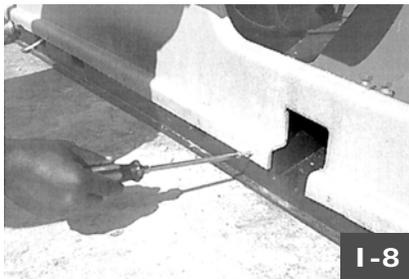
## Miscellaneous Items

### Step 1.

Place blue HDPE housing over the Solar Pedalflo, onto the black HDPE base. Secure housing with screws removed during unpacking (I-8).

### Step 2.

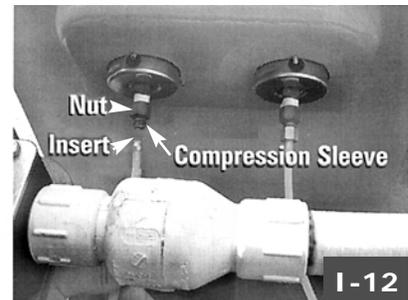
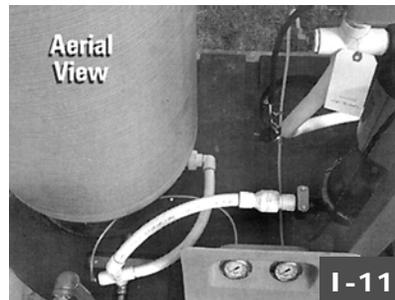
Connect the relief valve hose to barb on HDPE blue housing (I-9).



Aerial View from inside the Cover

### Step 3.

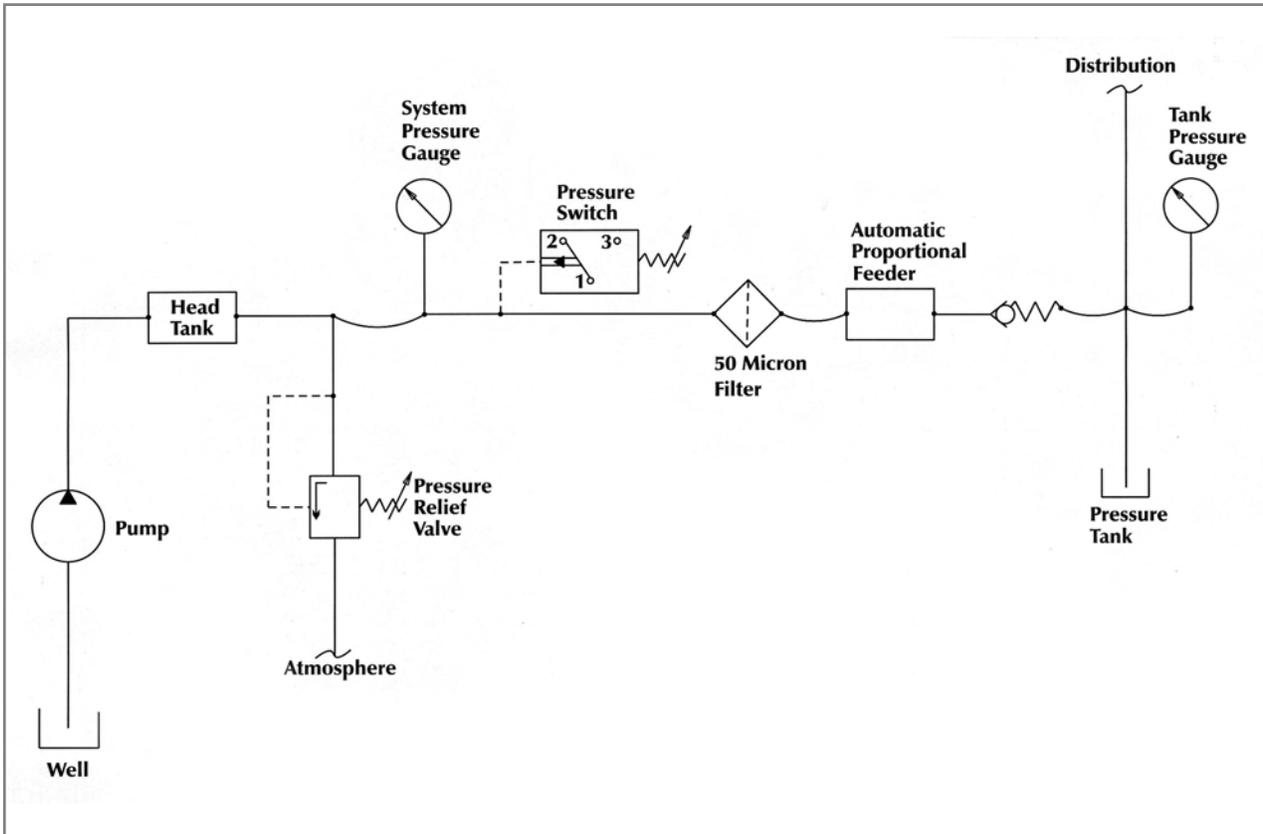
Connect the system pressure and tank pressure lines to the pressure gauges (I-10, 11). Verify that the brass nut, compression sleeve, and insert are located on the hose to be connected to the gauges (I-12). It might be necessary to use teflon tape on the threads to prevent leaks.



## Notes

## Hydraulic Circuit of the Solar Pedalflo

(Shown with Pressure Tank and Chlorine Feeder Attachments)



## J. CONNECTING ELECTRICAL COMPONENTS

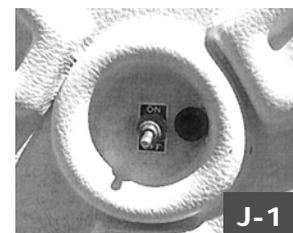
With the Solar Pedalflo components assembled, the electrical connections can be made.

### CAUTION: SHOCK HAZARD

Before proceeding further, make certain that the toggle switch is in the OFF position and the solar panel array is completely covered. There is a potential of electrical shock if solar panel array is not covered properly.

#### Step 1.

Install the toggle switch (on/off switch) by first removing the lock, face plate (on/off plate), nut, and rubber boot. Insert the toggle switch through the hole in the blue cover. From the outside of the blue cover, install components in the following order: lock ring, face plate, hex nut, and rubber switch boot. The rubber boot slides over the switch to protect it from water intrusion. (J-1)

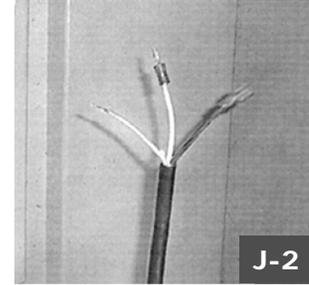


**Step 2.**

On the inside of the cover, connect the short black jumper from the fuseholder body to the bottom right connection of the toggle switch.

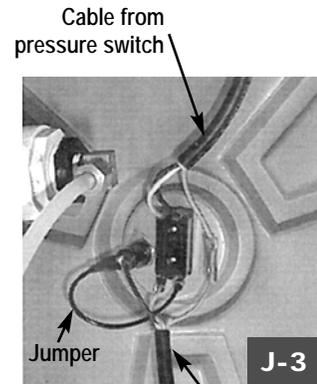
**Step 3.**

Slide the 25 foot long black cable from the solar panel stand s linear current booster under the blue SPF cover. Connect the female terminal end crimped to the black wire (J-2) to the second connection on the fuseholder body (J-3). Connect the fork terminal on the white wire to the lower left terminal of the toggle switch. Crimp the green wire into the butt connector that is connected already to the green wire from the pressure switch.



**Step 4.**

The white wire from the pressure switch connects to the top left terminal on the toggle switch. The black wire from the pressure switch connects to the top right terminal on the toggle switch. (J-3)



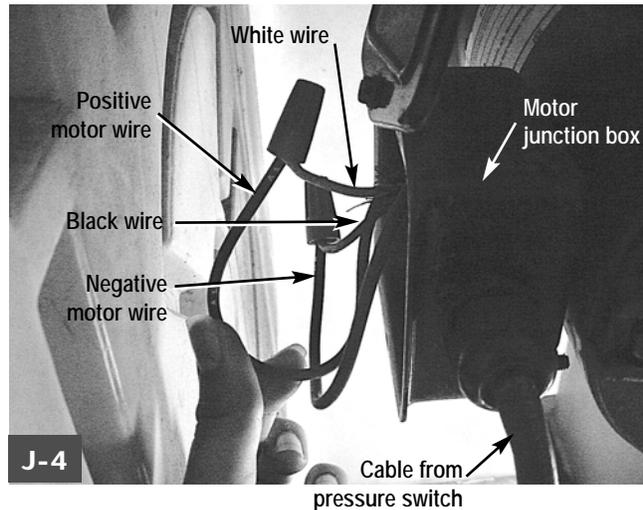
**Step 5.**

Check to make sure that the fuse is inserted into the fuseholder. To check, unscrew the fusecarrier in the black fuseholder body on the front cover and pull it out. Check to see if fuse is located within. If not, insert fuse. Then push the fusecarrier back into fuseholder body and turn 1/8th of a turn to lock in place. The fuse is important to keep the motor from burning out.

Cable from linear current booster

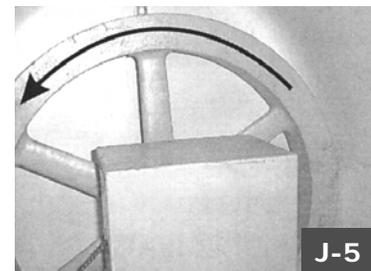
**Step 6.**

The cable from the pressure switch connects to the motor electrical box. (J-4) The white wire from the cable coming off the pressure switch connects to the positive (+) wire of the motor and the black wire connects to the negative (-) wire of the motor with wire nuts. The wire nuts screw onto the two exposed wire ends to entangle them together. The green wire needs a fork terminal and connects to the screw inside the motor junction box.



**Step 7.**

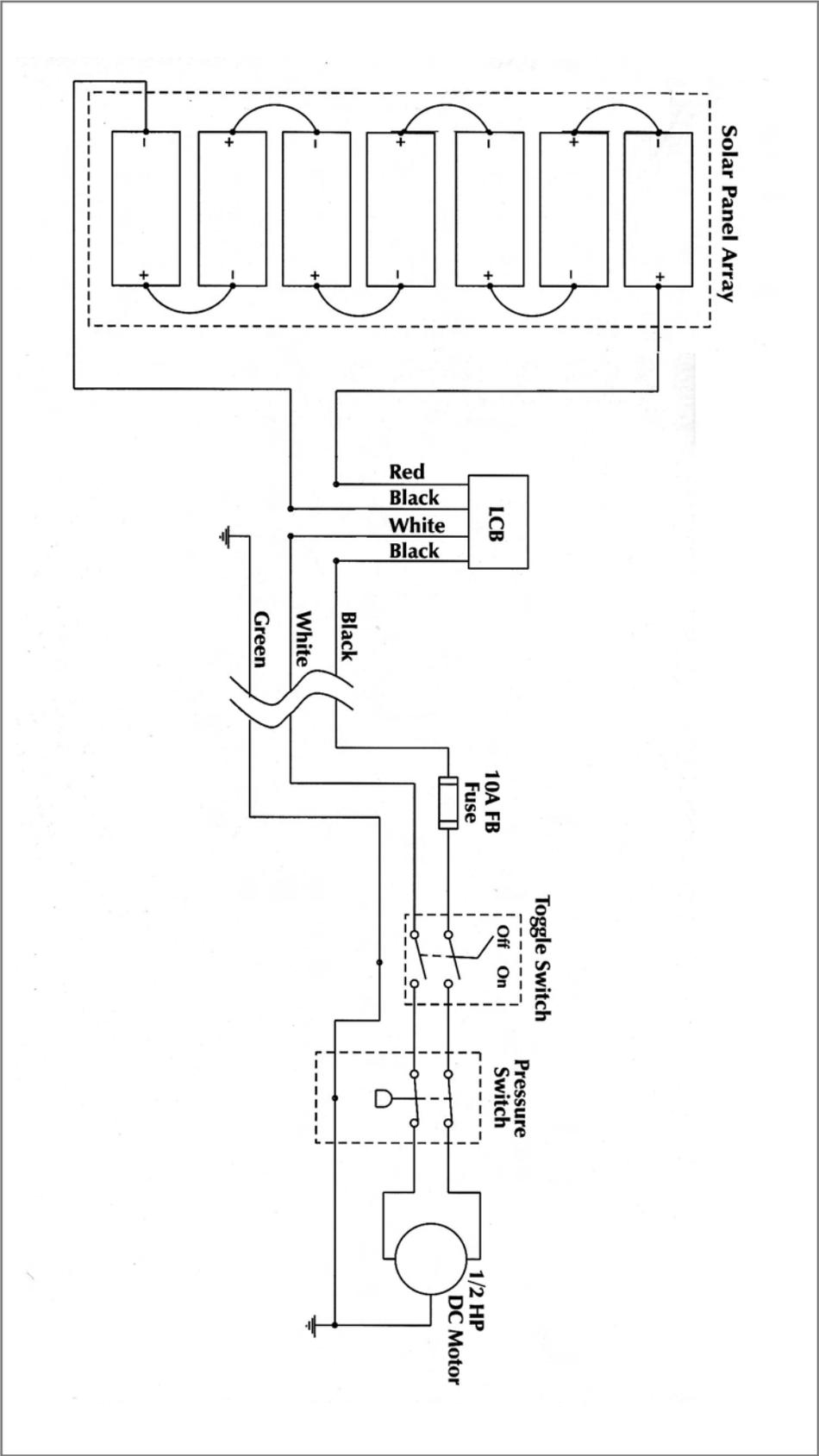
Switch the toggle switch in the linear current booster to on and then switch the toggle switch on the cover to on . This activates the motor to run the pump. From within the cover, check the rotation of the flywheel (J-5). The flywheel should rotate in a counter-clockwise direction. If not, remove the electrical box plate on the motor and switch the connections. The toggle switch in the booster can remain in the on position, even if pump switch is off.



**Step 8.**

Observe the Solar Pedalflo for any water leaks in the piping system and for any mechanical issues that may require readjustment.

# Electric Circuit of the Solar Pedalflo



## IV. OPERATION PROCEDURES

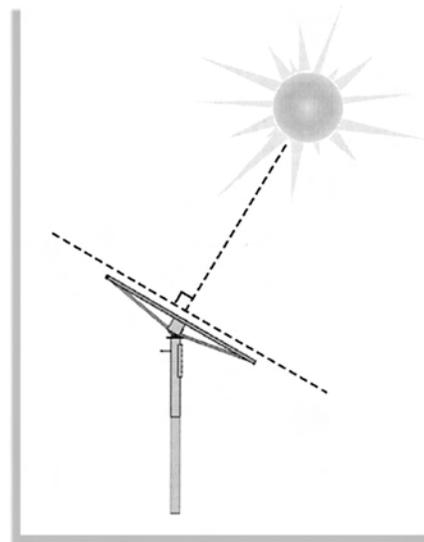
### A. UNDERSTANDING THE PRESSURE GAUGES

The pressure gauges are measuring the pressure of the water at two different points in the system. The system pressure gauge measures the pressure before the water goes through the filter and any other treatment devices. The tank pressure gauge reads the water pressure contributed by the storage tank or pressurized tank (after the water has been through the treatment devices). These two should have similar readings (within 5 to 10 psi of each other). The difference between the two gauges is a result of head loss through the treatment devices and plumbing components. If the difference between the two gauges is greater than 10 psi, the filter and the APF screen may need to be cleaned or replaced.

In addition, if using the pressurized tank, the tank pressure gauge will tell you when the tank is full. As the tank fills when all other outlets are closed, the pressure increases to a maximum limit preset by MWI (65 psi). When the limit is reached, the pressure switch turns the unit off and the relief valve relieves some of the water pressure. This is done to prevent the pressure from building up and causing damage to certain components of the SPF.

### B. POSITIONING OF SOLAR PANEL STAND

For receiving the best sunlight and producing the most from the SPF, it is important to have the ability to move the panel into the best position during the day. The panel array needs to be perpendicular to the sun (see figure). This is accomplished by adjusting the tilt of the array by putting the bolts into the proper location (see picture). In addition, the ability of the stand to swivel in order to move into the best position should be utilized.



### C. CHLORINATION

The water in the well should be tested prior to drinking to determine whether chlorination will be required. MWI recommends the water be tested by a certified laboratory for presence of coliform bacteria. Coliform bacteria are those associated with fecal contamination. In absence of a certified laboratory, MWI offers coliform testing kits (MWI part number PF65000) that can be performed in the field and will give results in 48 hours.

The Solar Pedalflo can be equipped with an Automatic Proportional Feeder (APF) that injects a chlorine mixture into the water to kill any bacteria and viruses that may be present in the water. MWI presets the feeder to a 0.1% dosage. To begin using the feeder, make sure the SPF is turned off. Check the wire screen located in the union receiving the water and make sure it is clean of debris. Make sure that all connections to the feeder are in tact. Use Table 1 in order to determine how much bleach to add to the water. Using Table 1 will result in a concentration of 3 mg./L of chlorine in the water.

**Note:**  
Chlorine will not kill Giardia or Cryptosporidium. These are protozoan parasites and can only be safely removed by proper filtration down to 1 micron or boiling of the water.

**It is highly recommended to only partake of the water coming from the storage tower or pressure tank.  
This gives time for the chlorine to work.**

Use Table 1 to determine how much to add depending on the bleach solution you have available locally. The % HOCL will be listed somewhere on the bottle. To use the APF, add the appropriate volume of bleach (Use Table 1) to the blue container first. Fill the remainder of the container with clean water. Put the cap back on the container and make sure the suction tube and filter assembly on the hose is fully extended into the container. Attach the suction tube to the fitting on the bottom of the feeder and make sure the bypass knob is locked in the UP position (see diagram). Turn the SPF on. Proper operation will be indicated by a clicking sound. One full blue container will last approximately 16 hours of operation before needing to be refilled.

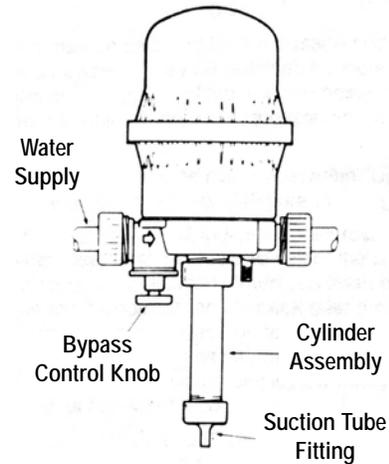


Diagram of APF for chlorination

Table 1			
Percent Bleach Solution (% HOCL)	Cups of Solution to add to blue container	Ounces of Solution to add to blue container	mL of Solution to add to blue container
1	24	192	5680
2	12	96	2840
3	8	64	1893
4	6	48	1420
5	4.8	38	1124
6	4	32	947
7	3.5	27	799
8	3	24	710
9	2.5	21	621
10	2.4	19	562

**Caution:**

**Excessive use of chlorine/bleach can be harmful. If uncertain about mixing the chlorine solution, consult MWI Corporation. When handling bleach, wear gloves and do not inhale the vapors.**

If chlorination is not needed, the APF has a bypass mode. To engage the bypass, turn the bypass knob half a turn counterclockwise when looking at the knob from the bottom and then pull down. The bypass is now engaged and water will flow through the feeder without injecting the chlorine solution. The suction hose can be disconnected if need be. To reengage the feeder, push the bypass control knob up and turn it half a turn in the clockwise direction when looking at the knob from the bottom. Reconnect the suction tube to the feeder.

Problem	Possible Cause	Remedy
No clicking sound	Improper installation	Check installation steps
	Piston is stuck	Remove cylinder assembly, move piston by hand
	Bypass is open	Close bypass knob to activate
	Broken extension spring	Replace extension spring (contact MWI)
Solution is not drawn up into the suction tube	Missing or worn check ball located in the suction tube fitting on the APF	Replace ball (contact MWI)
	Cracked or damaged cylinder	Replace cylinder (contact MWI)
	Worn flat washer on seal assembly in cylinder	Replace assembly (contact MWI)
Inaccurate proportioning	Worn or dirty check ball	Clean ball or replace (contact MWI)
	Check to confirm 0.1% spacer ring is located in cylinder.	Replace spacer ring (contact MWI).

## D. ADJUSTING THE PRESSURE SWITCH AND RELIEF VALVE

The pressure switch and relief valve are factory set to ensure that the Solar Pedalflo operates safely. If there is a need to adjust either the pressure switch or the relief valve, please contact your local MWI representative or call MWI corporate headquarters at (954) 426-1500.

## E. LINEAR CURRENT BOOSTER

The linear current booster has indicator lights on the right side. The red power in and green power out lights should be on if the booster is working properly. There is an over-current shut down built into the circuit of the booster that will turn the controller off when the current exceeds the current limit of the controller. It will turn the controller off for 3 minutes and then turn on again. When it turns off, the over-current light will flash at one-second intervals. When it turns on again, if it is still pulling excessive current, it will continue to shut down for 3 minutes and restart for three cycles, where it will then remain off for the remainder of the day unless manually reset by the toggle switch. In this mode, the over-current light will flash at half-second intervals. However, when the sun goes down at the end of the day, the controller will reset itself the next morning.

There is also a low-voltage disconnect which turns the pump off any time the voltage drops below a functional level. The low-voltage light will flash at one second intervals indicating that the controller has turned the pump off. The pump will remain off for 3 minutes and then restart. If the voltage is still too low, it will continue this cycle throughout the day until the voltage exceeds the minimum the controller needs to operate. The voltage minimum is preset at 26 volts.

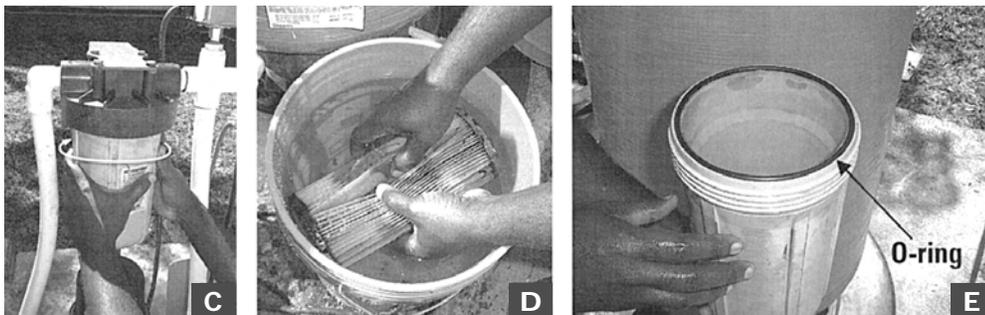
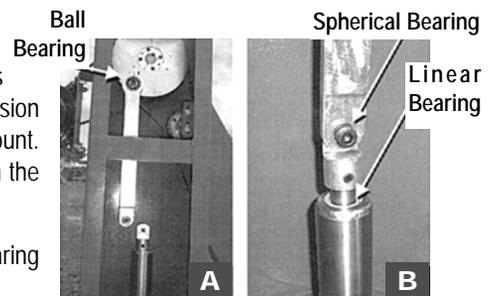
## V. SOLAR PEDALFLO MAINTENANCE

Regular maintenance of the Solar Pedalflo will increase the life of the unit, efficiently providing water for years to come. Appendix C provides easy to use check sheets that can be copied and used to guide the maintenance check and provide a record of actions performed.

### MAINTENANCE SCHEDULE

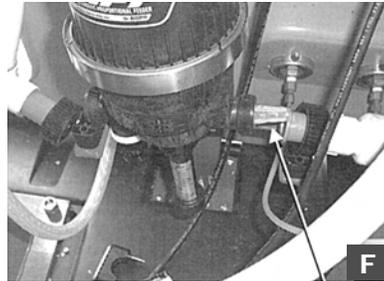
2  
Months

- Lubricate chains with 30W oil.
- Check tension and alignment of motor chain. Adjust as necessary. To adjust, use the weight of the motor to apply tension to the chain. Loosen the four nuts securing the motor to the mount. Allow the motor to slide down, tightening the chain. Re-tighten the four nuts.
- Visually inspect linear bearing, spherical bearing, and ball bearing for wear (A, B).
- The 50-micron filter is reusable: remove filter housing by turning blue housing clockwise (C), if looking from the top. Remove filter element and rinse with clean water, rinsing between each fold (D). Clean bottom of blue housing and place o-ring back in groove (E). Place filter element back in blue housing and reinstall. The 1-micron filter is not reusable. Replace if the pressure difference between the pressure gauges is greater than 10 psi.
- Check for leaks. If leaks found, consult troubleshooting for solutions.

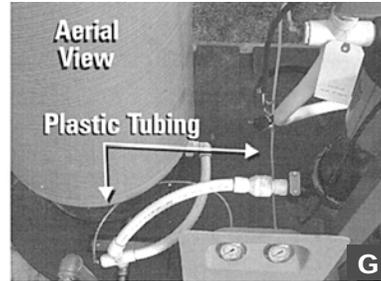


## 6 Months

- 2 Month list
- Check the APF (Automatic Proportional Feeder) screen located on the outlet side. Remove clamps on both sides of APF. Disconnect outlet union (F). Screen located inside outlet union. Clean as necessary
- Check tension and alignment of pedal chains. Adjust as necessary (See G-15).



APF Screen

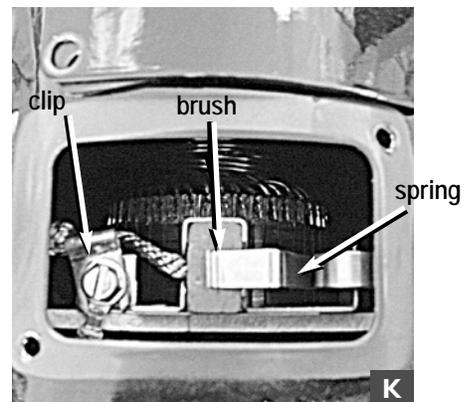
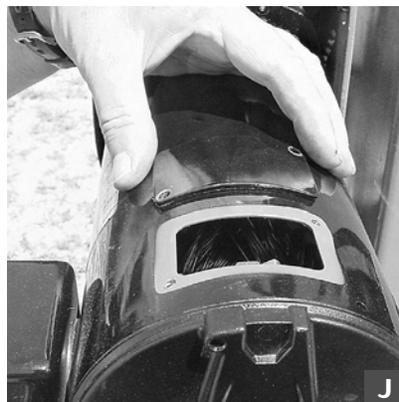
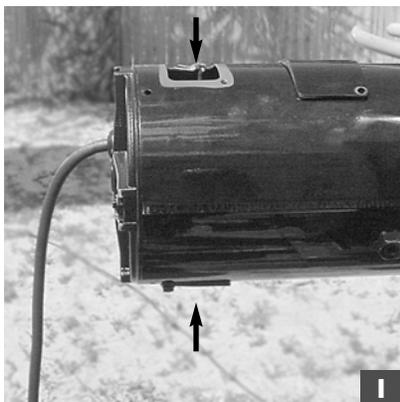


## 1 Year

- 2 Month list
- 6 Month list
- Check plastic tubing for cracks due to aging (G). If cracked, replace tubing.
- Examine plunger u-seal. In order to examine you must remove blue cover and disconnect connecting rod from guide rod. **First disconnect plastic tubing attached to gauges, remove nuts holding toggle switch in blue HDPE cover.** Push toggle switch through cover and lift the blue HDPE cover off the Solar Pedalflo base. Remove cover from main pump head. Disconnect the connecting rod from the guide rod. Unscrew guide rod housing using pipe wrench and lift up until pump rod is visible. Using Vice Grip rod clamp, secure the pump rod while removing the guide rod assembly by loosening the set screws. With guide rod assembly removed, begin removing pump rod sections, one at a time. Continue using rod clamp to secure each lower section of rod while removing upper section. With all pump rod and plunger valve removed, examine u-seal on plunger valve. It is recommended that the u-seal be replaced at this time, however, if in good condition it can be used (MWI Part # 90182).

## 2 Years

- Perform 1 year list
- Change carbon brushes on motor. There are two brushes in the motor. The access to these brushes is on the top of the motor and on the bottom (I). You must unscrew the plate coverings from the access. (J) Unscrew the clip holding the brush wire (K). Then lift up the retainer spring and pull the brush out. Replace with new brush and attach wire clip.



## VI. TROUBLESHOOTING

**Caution :** Before attempting to examine or repair the Solar Pedalflo, make sure the unit is turned off by toggling the on/off switch to the off position.

Removing the blue cover from the unit may be necessary in determining the root cause of a problem. In order to remove the cover, disconnect the plastic tubing attached to the pressure gauges and to the cover. Then remove the nuts holding the toggle switch to the front of the cover and push the switch through the cover. Then lift the blue cover off the black base. Removing the cover to the main pump head may also be necessary.

Problem	Possible Cause	Corrective Action
1. Water is leaking from the bottom of the head tank.	The rubber cone in the hanger plate is not adequately compressed.	Tighten the bolts according to the pattern illustrated on in Section F to compress the cone.
2. Water is leaking around the top of the guide rod housing.	A small amount of water coming from this location is normal. The water lubricates the bearings inside the housing. If there is a steady flow of water coming out so that it creates a large puddle on the bottom of the upper housing, then it is may be time for the lip seal to be replaced.	<b>Warning: Removing the guide rod housing incorrectly can cause damage to the threads of the housing and to the head tank, requiring both to be replaced and causing the SPF to become inoperable.</b> First, disconnect the guide rod from the connecting rod (see Section A-4). Using a pipe wrench, slowly add force to the wrench until the guide rod housing begins to turn. Continue until guide rod housing is completely loosened from the threads. Lift the housing up until you see the pump rod connected to the guide rod. Attach a vice clamp to the pump rod and disconnect the pump rod from the guide rod by loosening the set screws (see Section A-4). Remove the lip seal from the housing. You may also want to replace the bearings if they appear worn. Removing the bearings requires removing the retainer ring that hold the bearings in place with a screw driver. Replace the bearings and lip seal. Reattach the guide rod to the pump rod by tightening the set screws. Make sure the threads of the housing and head tank are clean of debris. Remove old teflon tape and reapply teflon tape to the housing. Carefully put the housing on the head tank and slowly begin to screw it in by hand first (then use the pipe wrench). If there is any resistance, stop, unscrew and realign the threads again. Once housing is screwed fully into the head tank, connect the connecting rod.
3. Water is leaking around the guide rod housing threads.	Guide rod housing is not tightened adequately or requires teflon tape.	Remove the guide rod housing from the head tank. Clean the threads and apply new teflon tape. Reinstall the guide rod housing carefully.
4. Water is leaking from the top of the filter housing.	Pinched or displaced O-ring.	Remove filter housing by unscrewing according to diagram C in Maintenance Section. Verify that the O-ring is seated in the groove. Reinstall the housing.
5. Water is leaking from a plumbing union (see plumbing layout drawing)	Missing or displaced O-ring.	Disconnect the union and verify that the O-ring is placed in its groove. Reconnect union.
6. Water is leaking from a plumbing piece or in between two pieces.	Damaged plumbing piece or bad connection.	Examine the pieces closest to the leak and make sure that there are no visible cracks. If the piece is damaged, you can order a new one by looking at the plumbing arrangement in Appendix and contacting MWI with the part number. If there is no visible damage, it may be possible to reglue the two pieces back together. Disconnect the two pieces and dry the inside. Put the purple PVC cleaner on both pieces. Then put on the PVC glue and reattach the pieces. Wait at least 15 minutes before turning the SPF back on.
7. SPF does not operate even though the switch is in the on position.	Several possible causes: 1) The pressure switch has shut the motor off. 2) The fuse has blown. 3) There is a bad connection between solar panels or between the solar panels and the motor.	<b>First check and confirm that the panels are wired in series according to the electric circuit shown in Section J and that the linear current booster is properly connected.</b> 1) Examine the system pressure gauge. If the system pressure is above 50 psi, the pressure switch has shut the motor off. Relieve pressure by opening a valve allowing the water to drain from the system until the system pressure is below 30 psi.

Problem	Possible Cause	Corrective Action
		<p>2) Open the fuse holder body by using a screwdriver and opening the top. Carefully slide the fuse out and examine. If the fuse is brown, discard and replace. It is MWI part number I06475.</p> <p>3) Have an electrician check the voltage at the on/off switch. In full sunlight, there should be greater than 90 volts going to the switch. If there is not, there may be problems with the linear current booster, assuming that everything is wired correctly according to the electric circuit. If no voltage is found, go to solar panel pole and read the voltage going into the linear current booster from the panels. If there is a voltage reading of over 90 volts in full sunlight, replace the linear current booster. If there is no voltage reading or voltage less than 90 volts, check the power coming from each panel. If there is less than 10 volts coming from a panel in full sunlight, then the panel may be bad and needs to be replaced. Contact MWI.</p>
<p>8. Noticeable reduction in water flow.</p>	<p>Several possible causes:</p> <ol style="list-style-type: none"> <li>1) The 50 micron filter or the APF feeder screen is dirty and is creating resistance to the flow of water.</li> <li>2) The seal on the plunger could be damaged or loose.</li> <li>3) One of the solar panels may be bad.</li> <li>4) The linear current booster failed</li> <li>5) A riser pipe may be cracked. Unusual, but could happen if the pressure switch malfunctioned and the system pressure built up above 100 psi until the riser pipe burst.</li> </ol>	<ol style="list-style-type: none"> <li>1) Check the system pressure gauge and the tank pressure gauge. If the tank pressure is 10 psi or more higher than the system pressure, the filters need to be cleaned or replaced. For the 50 micron filter, remove the filter housing and clean according to the instructions under Solar Pedalflo Maintenance. To remove the APF screen, follow the instructions under Solar Pedalflo Maintenance.</li> <li>2) Follow the directions for changing the seal under Solar Pedalflo Maintenance.</li> <li>3) Follow the instructions under Problem 7-3 on examining the solar power connections to ensure the unit is receiving the appropriate amount of voltage.</li> <li>4) Check voltage going into and coming out of booster. If no current coming out, then replace booster. Contact MWI.</li> <li>5) Warning: this would be a last resort in determining why the system is not producing the flow rates that it should. Disassemble the main pump assembly. Remove the pump rods. Pull up and examine the riser pipes. The entire riser pipe system may need to be replaced since they are glued together during installation. The pipes are standard 63 mm pipe size with belled ends.</li> </ol>
<p>9. Water leaks from underneath the pressure tank.</p>	<p>Poor or broken plumbing connection.</p>	<p>Loosen and remove all connection to the pressure tank. Allow the water to drain from the pressure tank. Slowly tilt the tank over and inspect plumbing pieces coming out of tank for leaks. Add teflon tape to the threads of the PVC tee and reattach. Put pressure tank back and reconnect the plumbing connections.</p>
<p>10. Banging noise is heard inside pump housing assembly.</p>	<p>Two possible causes:</p> <ol style="list-style-type: none"> <li>1) The bearings on the connecting rod are damaged or worn. See diagram on page 3.</li> <li>2) The chain broke — this would result in no water being pumped.</li> </ol>	<ol style="list-style-type: none"> <li>1) Disconnect the connecting rod from the guide rod. Remove the spherical bearing and ball bearing from the connecting rod and examine for damage. Replace if needed.</li> <li>2) Replace chain. If you need more chain or links, contact MWI.</li> </ol>
<p>11. Loud grinding/banging noise is heard by the motor.</p>	<p>The motor clutch is damaged.</p>	<p>Examine the motor clutch assembly and see if the sprocket is turning when the unit is turned on. If the sprocket is not spinning, but the inside piece attached to the motor is, then the clutch needs to be replaced. Contact MWI. <b>In order to prevent clutches from breaking, it is extremely important that the counterweights be set at the appropriate radius on the flywheel corresponding to the TDH of the system.</b></p>

## Notes

## VII. SPARE PARTS

The following is a list of spare parts for the Solar Pedalflo. If you need any of the items on this list, please contact either your local MWI representative or MWI directly by utilizing any of the methods below:

**Telephone:** 954-426-1500  
954-426-1505

**Fax:** 954-426-1582  
954-426-8938

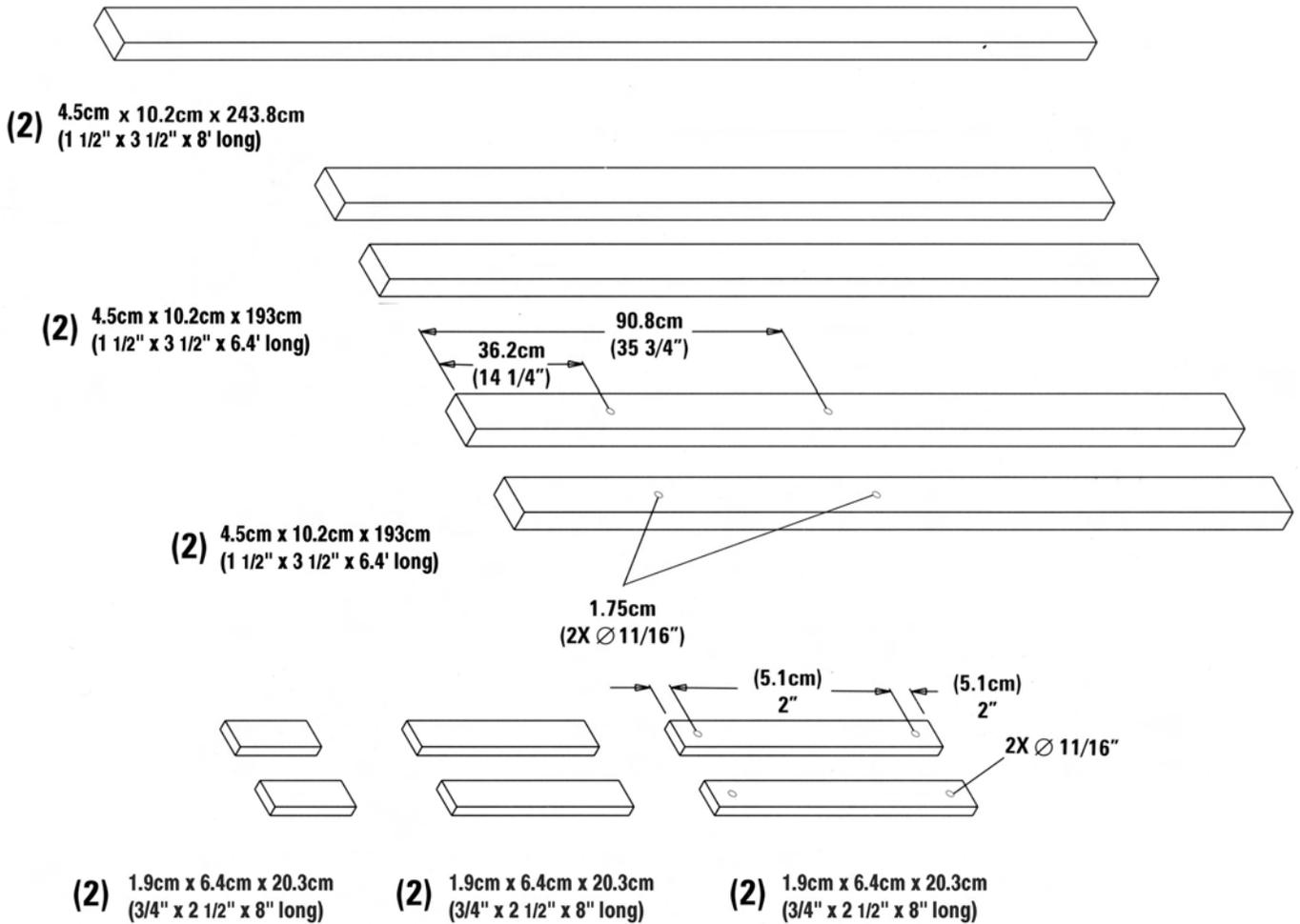
**website:** [www.mwicorp.com](http://www.mwicorp.com)  
and go to Contacts or Part and Services

MWI NUMBER	DESCRIPTION
<b>Solar/Electric Components</b>	
I06475	10 AMP FAST BLOW FUSE
I06456	FUSE CARRIER
I06455	FUSEHOLDER BODY
PF53500	140 WATT SOLAR PANEL
PF53000	50 WATT SOLAR PANEL
I06708	TOGGLE SWITCH
I02360	PRESSURE SWITCH
PF450810	FOX BOX : MISC ELECTRICAL COMPONENTS
<b>Motor Components</b>	
PF55017	CARBON BRUSH FOR MOTOR
APF04000	COMPLETE MOTOR CLUTCH ASSEMBLY
PF52137MOD	MOTOR CLUTCH SPROCKET (35A54)
PF55027	SPRING FOR GEAR MOTOR
R15120	GEAR MOTOR, 1/2 HP
<b>Mechanical Components</b>	
PF52140MOD	CRANK SPROCKET (35A80)
PF52120MOD	PEDAL CLUTCH SPROCKET (35A30)
PF52130MOD	PEDAL CRANK SPROCKET (35A32)
APF03020	CHAIN FROM MOTOR CLUTCH TO CRANK
APF01830	CHAIN FROM PEDAL CLUTCH TO CRANK
APF01950	CHAIN FROM PEDALS TO PEDAL CLUTCH
APF01500	COMPLETE CONNECTING ROD ASSEMBLY
APF01400	COMPLETE GUIDE ROD ASSEMBLY
APF01800	COMPLETE PEDAL CLUTCH ASSEMBLY
J21000	CONNECTING ROD BEARING
J16000	INNER SHAFT BEARING
J03760	LINEAR LOWER BEARING
J03770	LINEAR UPPER BEARING
APF01450	RETAINING RING FOR LINEAR BEARING
U08500	LOCK-N-SEAL ADHESIVE
J15500	OUTER SHAFT BEARING
J15000	PEDAL BEARING
E16500	U-SEAL FOR GUIDE ROD HOUSING
PF52170	PEDALS SET
J04970	SPHERICAL BEARING
BB29200	SLOTTED SPRING PIN FOR GUIDE ROD
<b>Plumbing and Water Treatment Components</b>	
I05070	PRESSURE GAUGE
PF54030	5 GALLON CONTAINER FOR CHLORINATION
APF00610	FLOAT VALVE FOR PRESSURE TANK
G00755	RELIEF VALVE
PF450602	PRESSURE TANK FIELD KIT
PF450601	CHLORINATION FIELD KIT
PF51075	50-MICRON FILTER CARTRIDGE
<b>Below Ground Components</b>	
90186	U-SEAL FOR BRONZE PLUNGER
90168	U-SEAL FOR PLASTIC PLUNGER
90167	VALVE BOBBIN
90170	O-RING FOR FOOTVALVE
PF50200	CENTRALIZERS FOR PUMP RODS
90159	4" PIPE CENTRALIZER
APF00510	PUMP ROD (2950MM IN LENGTH)
APF00520	PUMP ROD (750MM IN LENGTH)
<b>Miscellaneous</b>	
PF52180	SEAT
PF450805	TOOL KIT

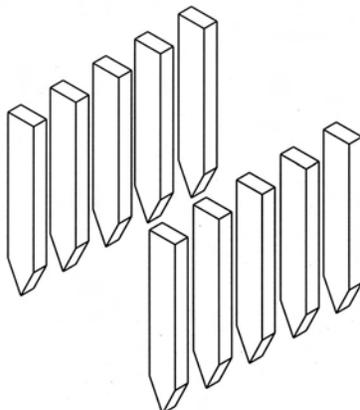
# APPENDIX

# VIII. APPENDIX A List of Materials Required for Base Form

Items necessary to build the concrete base frame for the Solar Pedalflo. The diagrams and materials listed are based upon using a standard 2 x 4, which is actually 1 1/2" x 3 1/2" and a 1 x 3, which is actually 3/4" x 2 1/2". The dimensions shown are the exact values, not nominal values.

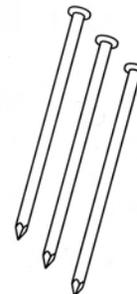


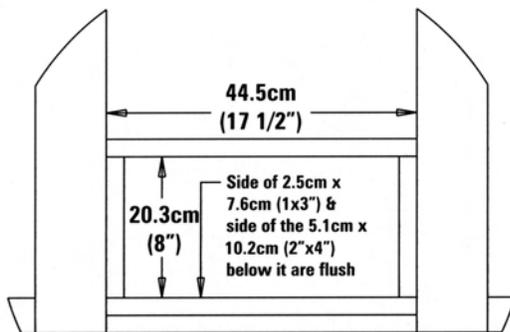
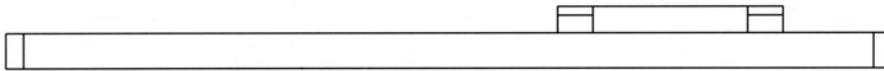
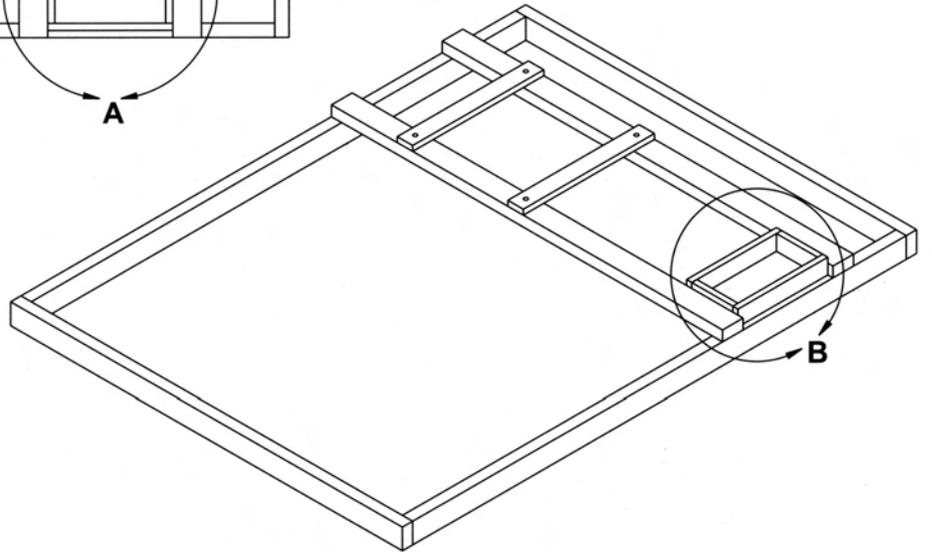
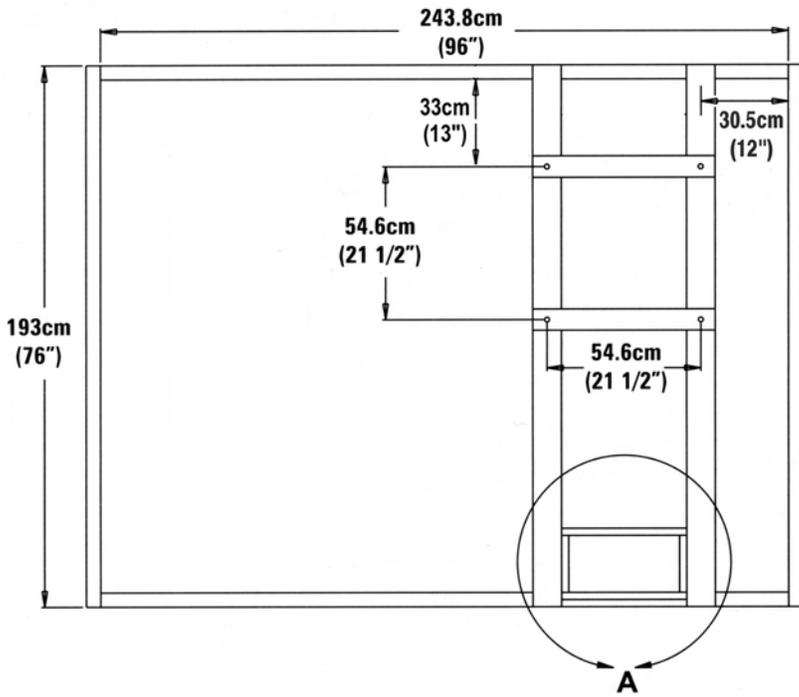
(10) Stakes are needed to secure the outside frame preventing the weight of the concrete to push the frame outward.



(40) 8.9cm (3 1/2" long)

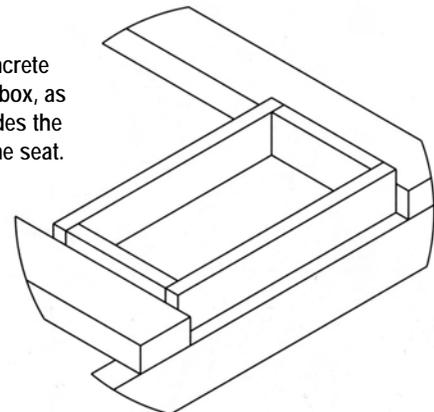
16-Penny Nails are needed





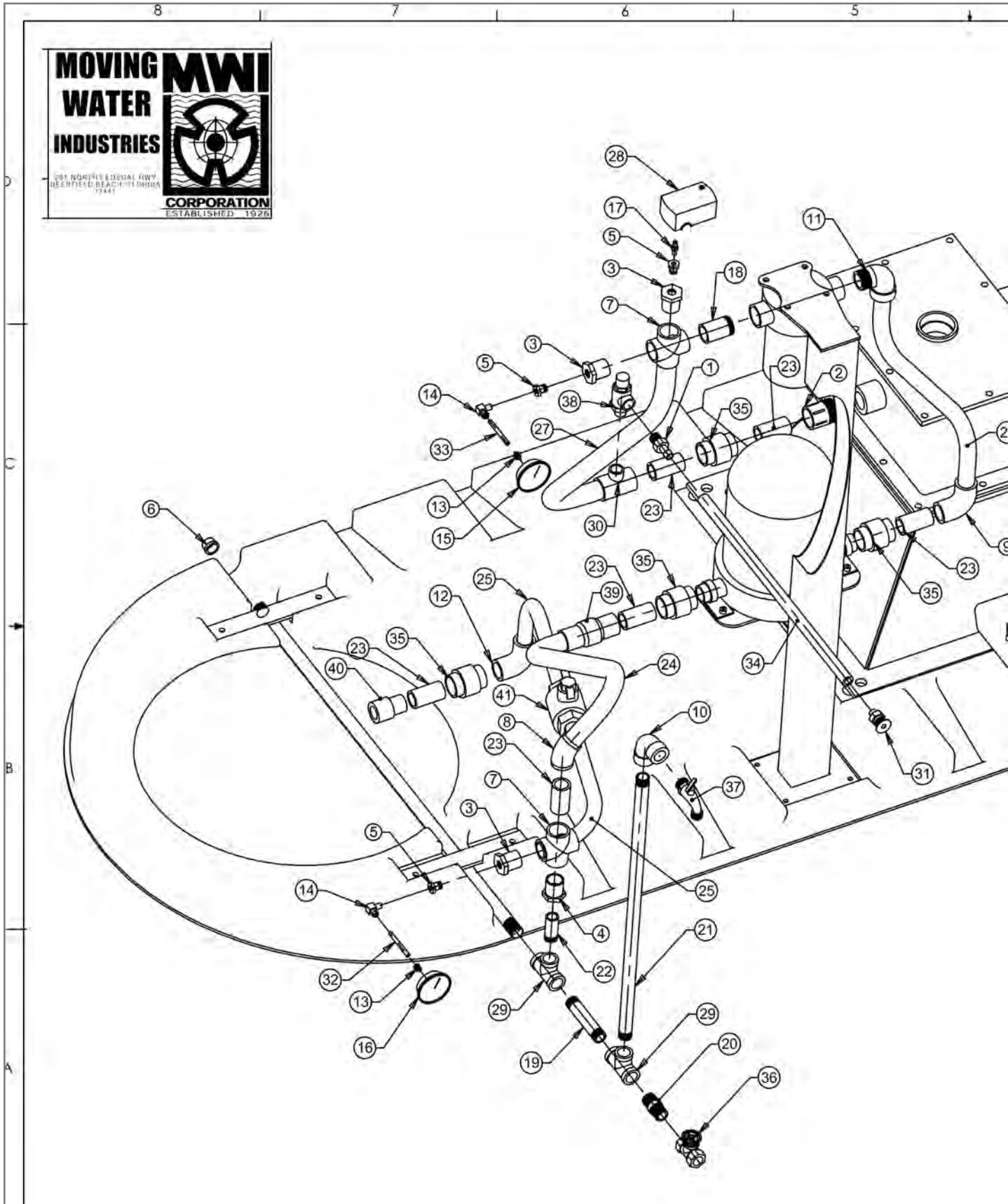
**DETAIL A**

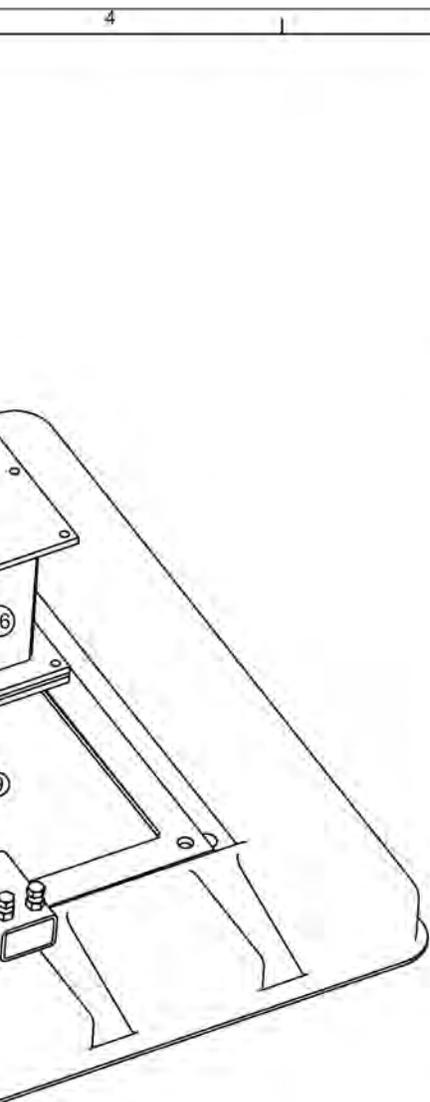
Pour concrete inside the box, as this provides the base for the seat.



**DETAIL B**

# IX. APPENDIX B Solar Pedalflo System Plumbing





Item #	Description	Material	Part #	Qty
41	1" Ball Valve	PVC	G02255	1
40	Coupling, Reducer, 1 1/4" - 1" Sch 40	PVC	S60000	1
39	Valve, Check Spring, 1" Slip, (FLO #1011-10)	PVC	S96500	1
38	Valve, Relief, Low Pressure, 1/2" MPT Inlet, 65 PSI	Bronze	G00755	1
37	Valve, Hose Bib, 3/4" MPT	Bronze	G00035	1
36	Valve, Gate, 3/4" FPT	Bronze	G00120	1
35	Union, 1" Slip, Sch 40	PVC	S96200	4
34	Tubing, Polyester braid reinforced, 1/2" ID x 24"	PVC	C08070	1
33	Tubing, .25 OD x .17 ID x 40" long	nylon	APF5071	1
32	Tubing, .25 OD x .17 ID x 30" long	nylon	APF5070	1
31	Thru-Hull Fitting, 1/2" x 1 1/4" Flange,W/Nut	Plastic	PF51130	1
30	Tee, Combination, Reducing, 1" Slip x 1" Slip x 1/2" FPT, Sch 40	PVC	S95200	1
29	Tee, 3/4" Sch 40	Galvanized Steel	B03110	2
28	Switch, Pressure (Square D #9013-FYG-2J21P)		I02360	1
27	Spa-Flex, Hose, 1" x 36" long	PVC	WP000045	1
26	Spa-Flex, Hose, 1" x 24" long	PVC	WP000045	1
25	Spa-Flex, Hose, 1" x 12" long	PVC	WP000045	2
24	Spa-Flex, Hose, 1" x 16 1/2" long	PVC	WP000045	1
23	Pipe, 1" x 2 1/4" long, Sch 40	PVC	S05200	5
22	Nipple, 3/4" MPT x Slip x 2" long	PVC	S86001	1
21	Nipple, 3/4" x 24" Sch 40	Galvanized Steel	A34320	1
20	Nipple, 3/4" Close, Sch 40	Galvanized Steel	B07110	1
19	Nipple, 3/4" x 4" Sch 40	Galvanized Steel	A34310	1
18	Nipple, 1" Male Slip x 1" MPT x 4" long	PVC	S81000	0.5
17	Hex Nipple, 1/4" NPT	Brass	C39700	1
16	Gauge Pressure 100 PSI, 2 1/2", 1/4" NPT Back Connection Tank Pressure)		I05070	1
15	Gauge Pressure 100 PSI, 2 1/2", 1/4" NPT Back Connection (System Pressure)		I05070	1
14	Fitting, Compression, Male Elbow, 1/4 x 1/4 NPT	Brass	C39900	2
13	Fitting, Compression, Female, 1/4" x 1/4", FPT	Brass	C39800	2
12	Elbow, 90 Deg, Street, 1" Slip, Sch 40	PVC	S68100	1
11	Elbow, 90 Deg, Street, 1" Slip x 1" MPT	PVC	S68000	1
10	Elbow, 90 Deg, 3/4" Sch 40	Galvanized Steel	B00410	1
9	Elbow, 90 Deg, 1" Slip x Slip, Sch 40	PVC	S66200	1
8	Elbow, 45 Deg, 1" Slip, Sch 40	PVC	S66000	1
7	Cross, 1" Slip	PVC	S65000	2
6	Cap, 3/4 Sch 40	Galvanized Steel	B04210	1
5	Bushing, Reducing, 1/2" MPT X 1/4" FPT	Plastic	S19100	3
4	Bushing, Reducing, 1" Slip x 3/4 Slip	PVC	S31600	1
3	Bushing, Reducing, 1" Slip x 1/2 FPT	PVC	S20500	3
2	Adaptor, 1 1/4" MPT x 1" Slip	PVC	S18300	1
1	Adaptor, 1/2" Hose Barb x 1/2" NPT	Plastic	PF51140	1
<b>Item #</b>	<b>Description</b>	<b>Material</b>	<b>Part #</b>	<b>Qty</b>
<b>Bill Of Materials</b>				

# X. APPENDIX C Maintenance Sheets

These sheets that can be copied and used for keeping records of any maintenance performed on the Solar Pedalflo.

## Turn off SPF before performing maintenance check

Date:	Maintenance Inspector:	Location:	System IDH:
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I. Main Pump Head	Schedule			Observations / Actions
		Yes	No	
a. Are the chains well-lubricated?	2 months			
b. Are chains able to flex 1.2 cm (1/2")?	2 months			
c. Chain from crank plate sprocket to motor clutch sprocket is properly aligned?	2 months			
d. Linear, spherical, and ball bearing tight and in general good condition?	2 months			
e. Guide rod in good working condition?	2 months			
f. Plunger u-seal in good condition?	1 year			
g. Pump head area generally clean?	2 months			

II. Flywheel and DC Gear Motor	Schedule			Observations / Actions
		Yes	No	
a. Flywheel in good physical condition and turns smoothly?	2 months			
b. Flywheel rotation is in correct direction?	2 months			
c. Flywheel weights positioned appropriately (see manual)?	2 months			Number of weights: Counterweight radius:
d. Is DC gear motor operating smoothly with little noise?	2 months			
Replace carbon brushes	2 years			
e. Motor housing is in good physical condition?	2 months			
f. Electrical connections are tightly sealed?	2 months			
g. Electrical wiring and cables are in good physical condition?	2 months			

III. Pedal Housing Assembly	Schedule			Observations / Actions
		Yes	No	
a. Pedals turn smoothly?	2 months			
b. Ensure water is being pumped by pedals.	2 months			
c. Physical condition of seat area is good?	2 months			
d. Tension and alignment of pedal chains appropriate?	6 months			

IV. Filter and Chlorination Systems		Schedule	Yes	No	Observations / Actions
a. Filter housing removed and cleaned.		2 months			
b. Filter removed and cleaned.		2 months			
c. APF screen removed and cleaned?		6 months			
d. Verify that suction hose and bucket are in good physical condition?		2 months			
e. Chlorine Feeder is working properly?		2 months			
	% HOCL solution being used:				
	Volume of solution being added to blue container?				

V. Pressure Tank and Solar Pedalflo Housing		Schedule	Yes	No	Observations / Actions
a. Check plumbing components for leaks.		2 months			
b. Inspect gauge tubing for leaks or cracks.		2 months			
c. Relief valve house connected to barb?		2 months			
d. Check charge on pressure tank by using schroeder valve?			6 months		
	add pressure if need be				
e. Pressure switch operating properly?		6 months			
	Check by closing all valves and turning unit on.				
	Let pressure build up in pressure tank until the switch turns motor off around 55 to 60 psi.				

VI. Photovoltaic Array		Schedule	Yes	No	Observations / Actions
a. Panels in good physical condition?		2 months			
	Wipe panels clean with soap and water.	2 months			
b. Electrical connections are tightly sealed?		2 months			
c. Inspect inside of linear current booster for water infiltration or other damage		2 months			

VII. External Piping and other parts		Schedule	Yes	No	Observations / Actions
a. Check piping for leaks or damage.		2 months			
b. Check that faucet s work properly.		2 months			
c. Water tower in good condition?		1 year			
d. Elevated water tank in good condition?		1 year			
	Drain and clean inside of tank to remove debris or clay deposits.				

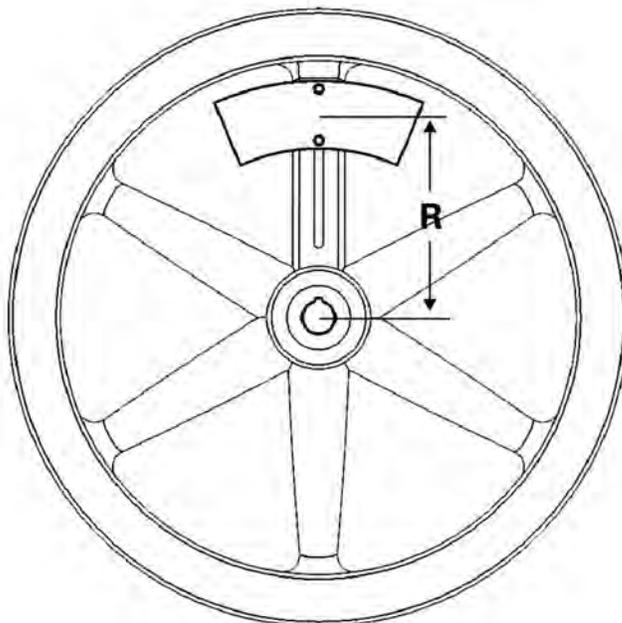
Operating Conditions					
<b>Perform these checks while unit is operating.</b>					
Flow rate in full sunlight:		If possible, have an electrician check the following:			
Pedaling flow rate (turn unit off to perform):		(in full sun)			
System pressure gauge reading:		Voltage going into the motor:			
Tank pressure gauge reading:		Voltage from panels into junction box:			

# XI. APPENDIX D Counterweight Settings for Solar Pedalflo

Water Depth (Meters) <sup>1</sup>	Tank Pressure (PSI) <sup>2</sup>	TDH of System (M) <sup>3</sup>	Number of Counterweights (14 lbs/ea)	Counterweight Radius (in) <sup>4</sup>	Counterweight setting radius (cm) <sup>4</sup>
10	0	11	1	12	31
10	5	15	2	7	19
10	10	18	2	9	22
15	0	16	2	9	22
15	5	20	2	10	26
15	10	23	2	11	29
20	0	21	2	12	29
20	5	25	3	9	22
20	10	28	3	9	24
25	0	26	3	10	24
25	5	30	3	10	27
25	10	33	3	11	29
30	0	31	3	11	29
30	5	35	3	12	31
30	10	38	4	10	25
35	0	36	4	10	25
35	5	40	4	11	27
35	10	43	4	11	29
40	0	41	4	11	29
40	5	45	4	12	31

Riser Pipe Setting (Meters) <sup>1</sup>	Tank Pressure (PSI) <sup>2</sup>	TDH of System (M) <sup>3</sup>	Number of Counterweights (18 lbs/ea)	Counterweight Radius (in) <sup>4</sup>	Counterweight setting radius (cm) <sup>4</sup>
45	0	46	4	9.9	25
45	5	50	4	10.4	26
45	10	53	4	10.9	28
50	0	51	4	11.0	28
50	5	55	4	11.5	29
50	10	58	4	12.0	31



<sup>1</sup> The Water Depth is the depth to the water below ground.

<sup>2</sup> The Tank Pressure is equal to the pressure in the pressurized tank or the height of the storage tower. (the highest point the water reaches).

- A storage tower height of 3.3 meters (12 feet) is roughly equal to a pressure of 5 psi.
- A storage tower height of 7 meters (23 feet) is roughly equal to a pressure of 10 psi.

<sup>3</sup> The Total Dynamic Head of the system is equal to the Water Depth plus friction loss (assumed here to be 1 meter) plus Tank Pressure (converted into meters of head).

<sup>4</sup> The Counterweight should be set at the appropriate distance from the center of the flywheel (see diagram). This is very important in order to decrease possible wear and tear on the motor components.

## XII. APPENDIX E Solar Pedalflo Installation Materials

These are **rough** estimates of what may be needed to complete the solar pedalflo installation along with a distribution points and fencing as shown in Appendix F. These quantities will vary depending on the layout design and does not include materials to build storage tower.

Note: Storage towers should be set to a height of only 10-15 feet tall if the predominant reason for the tower is for water storage. If you require water pressure in the pipes greater than 5 psi, then increase the height of the tower to provide more pressure.

Materials Needed	Quantity
Sharp sand or rough sand for concrete mix	7 cubic yards
Cracked stone (gravel) $\frac{3}{4}$ " in size	15 cubic yards
Cement mix (See Concrete quantity)	15 bags
Plastic/wire mesh for fencing	(5ft width) 25 feet length
2" square pipes for holding fence	6 pieces of 6 ft in length
mesh gate (3ft x 6ft with 2" sq pipe)	1

Materials Needed for Distribution Set Up	Quantity
Metric: Use 40mm for 1 $\frac{1}{2}$ ", 150mm for 6", 25mm for 1"	
1 $\frac{1}{2}$ " PVC pipe (19 feet long) for pipe distribution	6
1 $\frac{1}{2}$ " Brass gate valves with expansion coupler	3
1 $\frac{1}{2}$ " PVC 90 degree elbows	9
PVC cleaner and cement for connecting pipe	2 — 16oz bottles
1 $\frac{1}{2}$ " PVC tee for watering stations	1
6" class 6 PVC pipe	6 feet (1.83 meters)
6" PVC cap	2
1 $\frac{1}{2}$ " union coupler	1
1 $\frac{1}{2}$ " x " PVC reducer (40mm x 20mm)	2
1 $\frac{1}{2}$ " PVC cross	1
1 $\frac{1}{2}$ " x 1" PVC reducer (40mm x 25mm)	3
1 $\frac{1}{2}$ " PVC threaded coupler	1
1" PVC threaded coupling	3
3 $\frac{1}{2}$ " (90mm) class 6 PVC pipe	5 feet (1.5meters)
$\frac{3}{4}$ " PVC threaded bushing	2
1 $\frac{1}{2}$ " PVC threaded bushing	2
1 $\frac{1}{2}$ " PVC threaded 90 degree elbow	1
1 $\frac{1}{2}$ " galvanized coupler	1
1" brass spigot	3
1" brass ball valve	3
1" galvanized 90 degree elbow	6
40mm galvanized pipe male threaded on both end	6" (0.15 meters)
1" galvanized pipe male threaded on one end	3 nos of 6" each
1" galvanized pipe male threaded on both ends	3 nos of 21"(0.5m) ea
1" galvanized pipe male threaded on both ends	3 nos of 24"(0.6m) ea
1" galvanized pipe male threaded on both ends	3 nos of 27.5" (0.7m) ea
1" galvanized pipe male threaded on both ends	3 nos of 51"(1.3m) ea
1" galvanized pipe male threaded on both ends	67" (1.7m) in length
1" galvanized pipe male threaded on both ends	197"(5m) in length

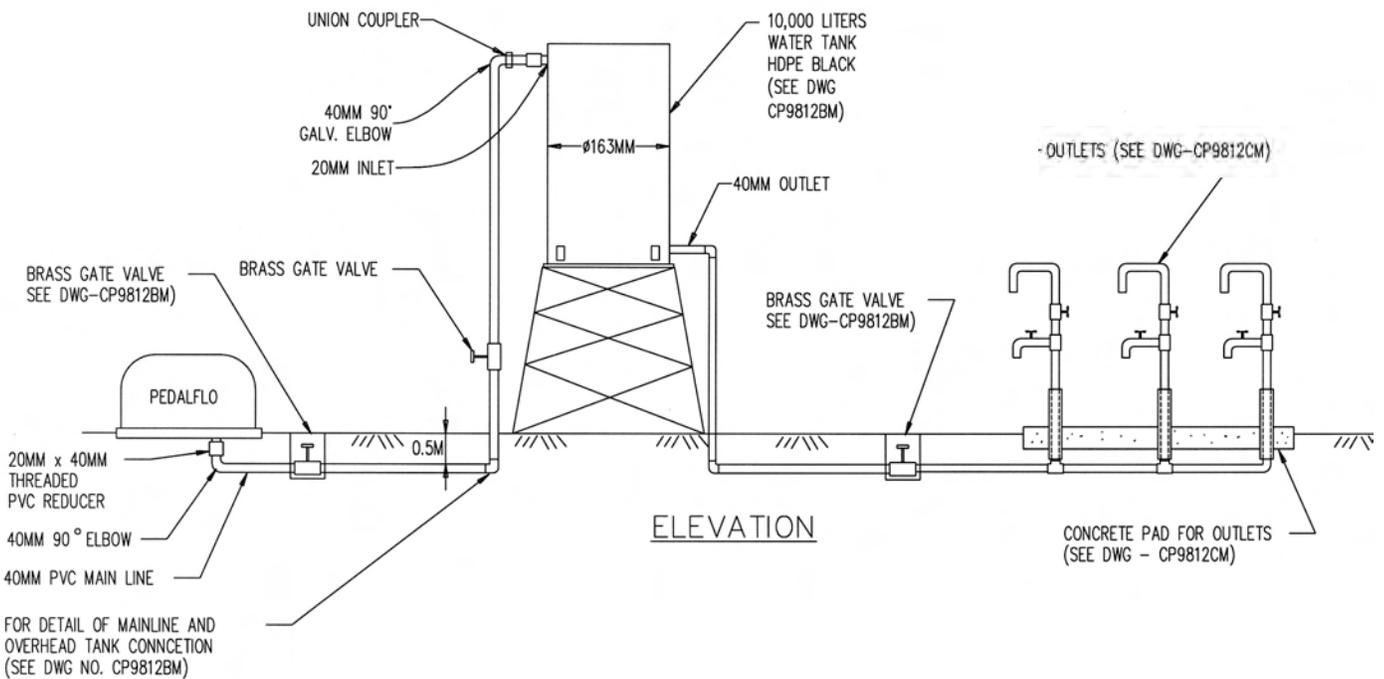
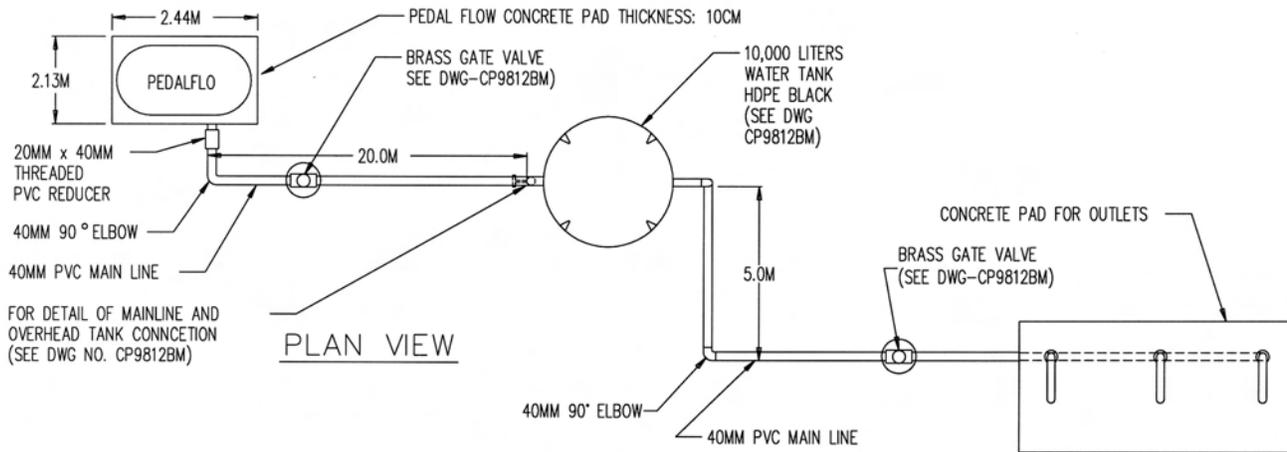
### Concrete Mixture ratio

1 bag cement : 2 bags of sand : 4 bags of gravel

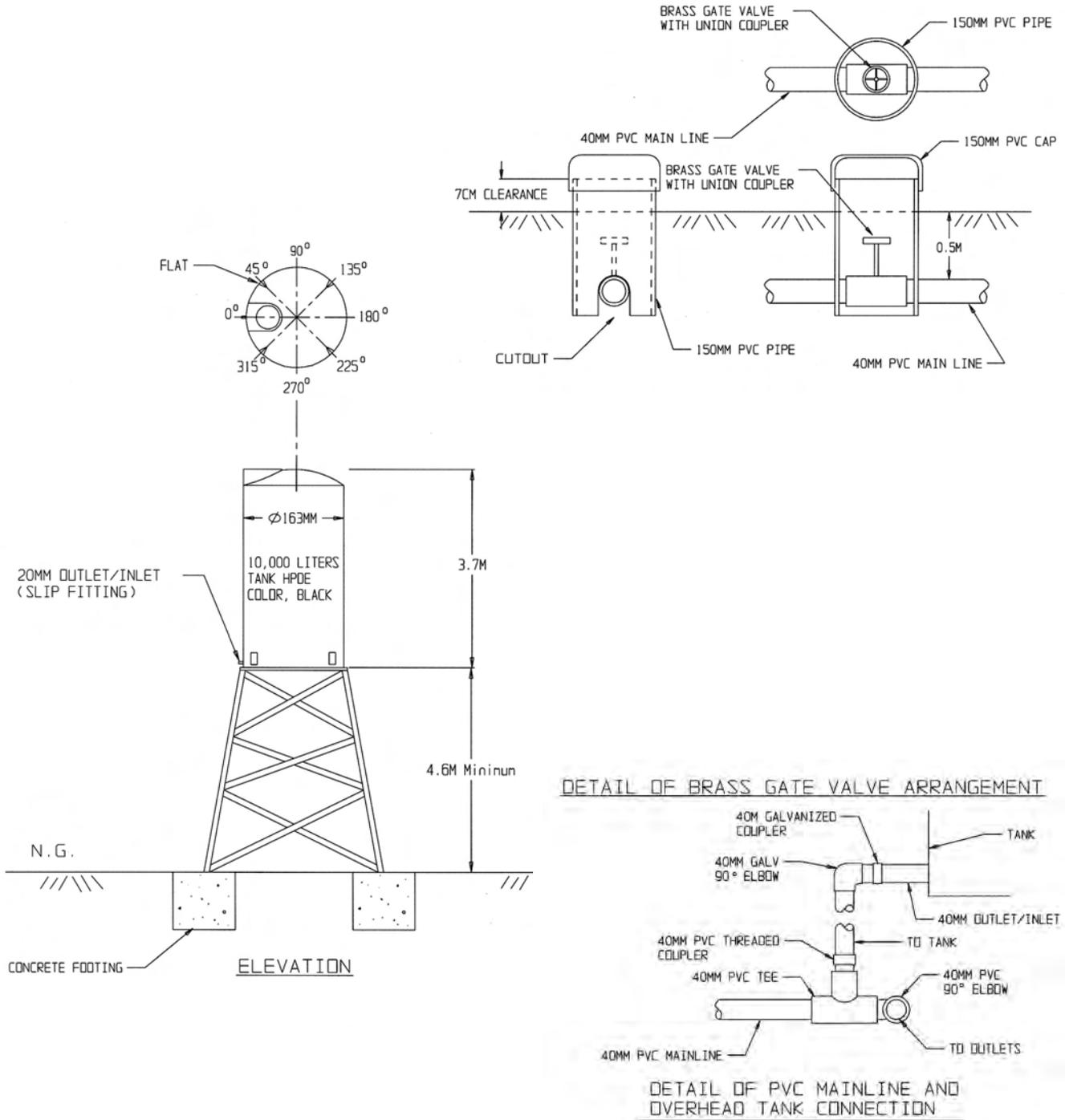
Note: Do the cast in the morning, then pour water over the cast in the evening and allow 12-24 hours for the concrete to fully form.

Concrete Quantity for SPF Layout	Quantity
Solar Pedalflo concrete base and solar stand base	4 — 5 bags
Overhead stand	3 bags
Distribution tap stand	4 — 5 bags
Fencing poles	2 bags

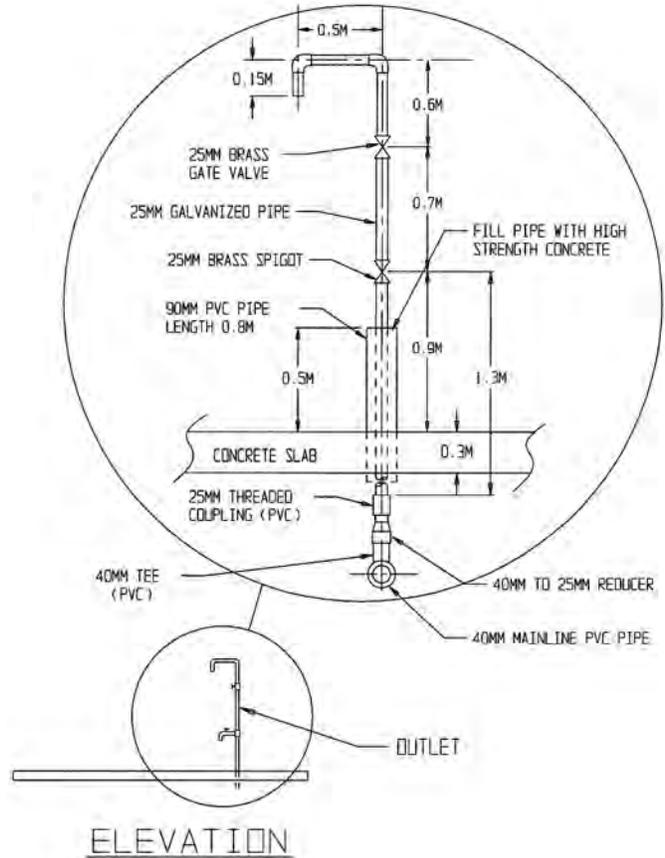
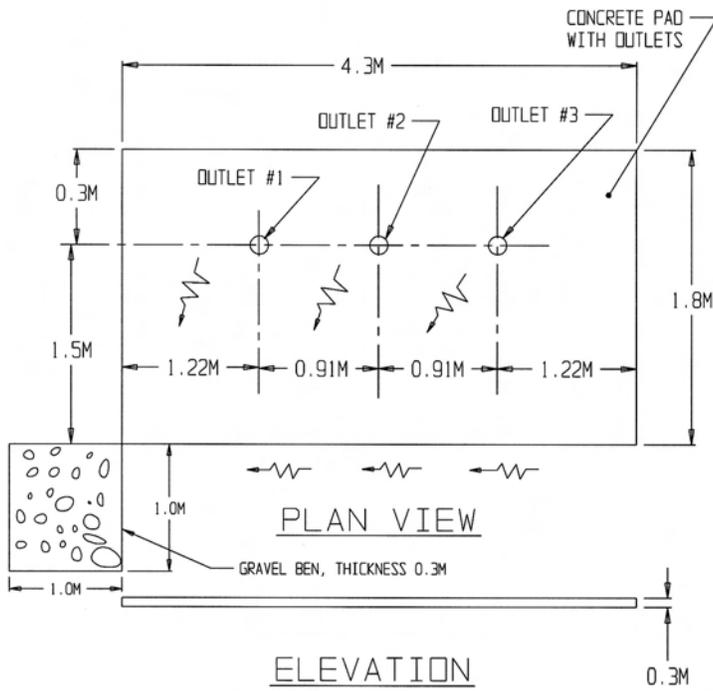
# XIII. APPENDIX F Water Distribution Example #1 - Part 1



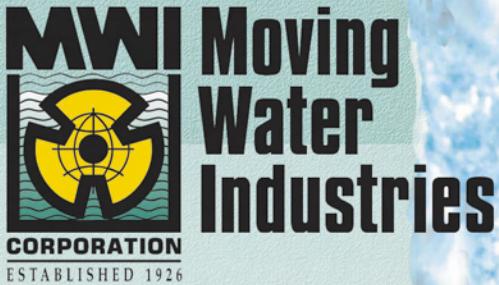
# Water Distribution Example #1 - Part 2



# Water Distribution Example #1 - Part 3



**Version 1.2**



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-  **No Electricity or Engines Required**
-  **Solar Primary Power, Human Secondary Power**
-  **Improves Health and Reduces Infant Mortality**
-  **Village Level Operation and Maintenance**

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